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Report of the
Ontario Council
of Health on

Annex "F"

Health Research

Ontario Department of Health
Honourable Thomas L. Wells, Minister



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Replacement Sheet

Please read pages 4 and 5
on this sheet rather than
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II Financing of Health Research

6. THAT, in the allocation of capital funds available from the Province for financing of health research, Recommendation 5 is applicable.
7. THAT a mechanism be evolved for establishing continuing collaboration among the Department of University Affairs, the Ontario Hospital Services Commission, and the Department of Health, for the provision of operating funds for health sciences centres.
8. THAT additional support, related to the aggregate salaries of the full-time staff engaged in health research, be made available from provincial funds for the sole purpose of sustaining the continuing basic cost of research activities of a discipline and related fields.
9. THAT all personnel (professional, technical and support) engaged upon health research, which is integrated closely with teaching or patient care, be financed through provincial funds identified with the institution.
10. THAT the Province maintain a flexible research support programme which complements existing programmes.
11. THAT, in order to maintain an effective professional staff in health sciences centres, an additional funding mechanism be developed to support a research activity which is essential for the education and service activities of the institution.
12. THAT applications for funds for basic multi-purpose equipment or for the more specialized project-oriented equipment be received and awards made as required, and be considered as a whole.
13. THAT proposals for contract health research initiated by agencies of the Provincial Government be reviewed by the Health Research Committee of the Ontario Council of Health, and recommendations made in respect to the scientific merit of the proposal and the method of study.

III Special Groups of Outstanding Merit

14. THAT the needs, in respect to resources and personnel for special groups in health research, warrant the reiteration

that Recommendation 5 covers the provincial need in this area.

IV Voluntary Health Agencies

15. THAT, because of the important and unique role played by the voluntary agencies, these agencies should be actively encouraged to continue to expand their activities. It is further recommended that, when a particular activity of the agency becomes part of the health care programme, the funding for this activity be provided on a continuing basis.

V Existing Provincial Support for Health Research

16. THAT the Provincial Role in Health Research continue to remain flexible and responsive to changing needs.
17. THAT all funds for health research provided by the Department of Health or other departments be identified as such in the annual estimates of the department concerned.
18. THAT foundations, such as the Alcoholism and Drug Addiction Research Foundation, the Ontario Cancer Treatment and Research Foundation, and the Ontario Mental Health Foundation, continue to be eligible to receive provincial grants for the support of the research component of their operation and, further, that the budgetary requests from these foundations be submitted annually along with an estimate of the requirements for the ensuing five years.
19. THAT, in view of the success of the above programmes and the rapidly emerging needs in health research, a machinery be developed to respond quickly to new needs as they become apparent.
20. THAT the three foundations, referred to in Recommendation 18 above, be encouraged to use peer group assessment and external referees in making allocations of research funds for both extramural and intramural research programmes.
21. THAT the allocation of all funds for health research by the Province be made on the recommendation of a representative review committee which has had the opportunity of appraising such arrangements for funds in the light of provincial needs, such a representative committee to report to the Ontario Council of Health, and Council in turn to advise the Minister on this matter



REPORT OF
THE ONTARIO
COUNCIL OF HEALTH

HEALTH RESEARCH

HEALTH
RESEARCH

REPORT
OCTOBER 1960

ONTARIO DEPARTMENT OF HEALTH
TORONTO, ONTARIO, CANADA



**REPORT OF
THE ONTARIO
COUNCIL OF HEALTH**

on

**HEALTH
RESEARCH**

ANNEX "F"
OCTOBER 1969

ONTARIO DEPARTMENT OF HEALTH
Honourable Thomas L. Wells, Minister



Produced for the
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FOREWORD

The report on The Provincial Role in Health Research was presented by the Committee on Health Research to the Ontario Council of Health at its meetings held between October 1968 and October 1969. Individual chapters of the report were received by Council and the recommendations, as listed herein, have been approved by Council.

Readers are reminded that, while the Ontario Council of Health has endorsed the report as printed, it did so without formally attempting to co-ordinate the views and recommendations presented with those presented by other Committees of Council. In view of this, it is possible that Council could adopt a modified position when the influences of recommendations by other Committees are assessed.

The report provides a definitive statement on health research and its components of biomedical research, health care research, developmental and applied research. It contains major recommendations concerning the development, co-ordination, and financial support of health research in all its aspects, interdisciplinary research and study programmes, scientifically trained personnel, and the development of a health services research capability. It also identifies roles in health research for Nursing, Pharmacy, and Dentistry, for disciplines allied to the health sciences, and for independent health agencies.

After completing its initial assignment by presenting its report on The Provincial Role in Health Research, the Committee was disbanded. In October 1969, a new Committee on Health Research was formed to advise the Minister of Health, through Council, on policy matters regarding health research in the province. Because of its importance, the new Committee will give serious consideration to the study of the economics of health research.

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REPORTING ON THE PROVINCIAL ROLE IN HEALTH RESEARCH

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Recommendations

RECOMMENDATIONS

The recommendations of this report are listed below to provide a quick guide for the reader. The Ontario Council of Health has approved the recommendations as presented.

I General Policy

1. THAT the following definition be considered as the Provincial Role in Health Research: “The provision of the facilities and resources necessary, in addition to those from federal and other sources, to achieve an integrated operation in respect to the pursuit of fundamental knowledge, and the application of this knowledge in the improvement of health, in the management of disease in the community, and in the assessment of the efficacy of health care.”
2. THAT, as a basis for determining funds for health research, allocations be considered in relation to the needs of health care programmes.
3. THAT, subject to Recommendation 1, provincial support ensure that the universities, communities, and government groups, have sufficient resources to provide a smooth interplay among the activities of education, research, and service.
4. THAT the Ontario Council of Health act as an advisory body through its committees to make appropriate recommendations in respect to the implementation of Recommendations 1, 2 and 3 above.
5. THAT the allocation of all funds for health research by the Province be made on the recommendation of a representative review committee which has had the opportunity of appraising such arrangements for funds in the light of provincial needs, such a representative committee to report to the Ontario Council of Health, and Council in turn to advise the Minister on this matter.

His responsibilities will include:

- a. to assist and maintain liaison with federal level library services;
 - b. to encourage private provincial associations which have significant library resources to participate within the provincial network;
 - c. to provide assistance and consultation services to network libraries.
6. THAT an operating committee be established, including the chief librarians of the health resource libraries and other appropriate persons, to work with the provincial co-ordinator who will be appointed chairman of the committee.
 7. THAT a health sciences librarian, located in the health resource library for the region, be designated regional co-ordinator.
 8. THAT, included in a network programme for information service, there be a field staff of librarians, available within each region, to provide professional consultation and advice to health sciences information facilities, whether or not such facilities form part of the designated information network.

Network Co-ordination and Mechanism

9. THAT health sciences librarians maintain close administrative arrangements and personal liaison with librarians of parent institutions, related libraries in other disciplines, and library organizations in the province and nation.
10. THAT, before a sophisticated system for interrogating files of computerized data is considered for Ontario, a relatively simple system and network be implemented. Successive objectives of the system would include:
 - a. compatibility of bibliographic records in all health sciences centre libraries;
 - b. a catalogue in machine readable form;
 - c. inexpensive book catalogues provided from the mechanized data base;

- d. each health resource library to hold book catalogues produced in other regions.
- 11. THAT every primary contact library subscribe to Index Medicus, both the monthly issues and the annual cumulation.
- 12. THAT all health resource libraries, and at least one health library in each centre having a group of hospitals or health services, have Telex.
- 13. THAT a controlled experiment be initiated with Inward WATS telephone information service when offered in Ontario.
- 14. THAT extension of an interlibrary courier service to major centres of health services be explored.

Health Library Manpower

- 15. THAT the Committee on Health Manpower direct its attention to the problem of adequate supply of health sciences information manpower, at both professional and technical levels, with indications of avenues of training and probable need as set out in this report.
- 16. THAT a health sciences librarian be included on the advisory committee for library technician courses at the colleges of applied arts and technology, wherever it seems likely that diplomates from these courses may find employment in health sciences libraries. Such advisory committees are already recommended in general terms to include a representative from the field of special librarianship.
- 17. THAT the development of a health sciences information network make adequate provision for a continuing programme of training for health sciences information technicians, both by the provision of short courses for staff now active in such units, and by the provision of training for health sciences technicians interested in transferring to the information field.
- 18. THAT courses for library technicians make available specific technical subjects for health sciences information technicians—for example, familiarity with reference tools in the health sciences.

(Recommendation 5). (In this way allocations to the three foundations referred to above would be considered at the same time and in the same context as other new research programmes such as the provincial research grant programme initiated in 1968.)

VI Developmental and Applied Research

22. THAT consideration be given to providing administrative arrangements and provincial resources in support of applied and developmental research associated with health care in this province.
23. THAT, in effecting this proposal, there be careful co-ordination with other agencies now supporting programmes in health research.
24. THAT, in order to improve the quality and extent of applied and developmental research, new training programmes and special funding mechanisms be applied to this area when required.

VII The Interdisciplinary Nature of Health Research

25. THAT, since resources are limited and it is important to maintain high standards in all areas of health research activity, encouragement be given to the development of comprehensive graduate school programmes in the health sciences.
26. THAT to achieve the objectives of Recommendation 25, mechanism be developed to encourage and support interdisciplinary research and graduate study programmes among all the health disciplines.
27. THAT encouragement be given for multidisciplinary research programmes and graduate programmes involving university and community groups.

VIII The Training of Research Personnel

28. THAT support be provided to encourage the training of suitable individuals in health research; the programmes be such as to identify students with talent and facilitate and encourage their development; and the training programmes be of a uniformly high standard.

29. THAT university graduate schools be sufficiently broad and flexible so that effective graduate programmes on an interdisciplinary basis in health sciences be encouraged.
30. THAT the training requirements of professional organizations and universities be such as to encourage rather than discourage the scientific training of personnel in the clinical areas.
31. THAT special funding be provided to help initiate and develop combined professional and Ph.D. programmes.
32. THAT special programmes be established to enable existing members of staff to undergo any special retraining, related to research activities, which is considered necessary by both the individual and the health sciences centre.

IX Health Research in Dentistry, Pharmacy, and Nursing

33. THAT research in dentistry, pharmacy, and nursing, be part of an interdisciplinary research programme in the health sciences.
34. THAT, in keeping with the recommendations on the interdisciplinary nature of health research, graduate research programmes in dentistry, pharmacy, and nursing, be oriented in terms of the research objectives, rather than a sectional interest of the professional personnel involved.
35. THAT, when necessary, special fellowship programmes be established to encourage the training of individuals in health research in the disciplines of dentistry, pharmacy, and nursing.
36. THAT special programmes be instituted for retraining purposes. The special programmes related to retraining are particularly applicable to dentistry, pharmacy, and nursing. (See Recommendation 32.)
37. THAT, because of the importance of prevention in dental care and the need for research in this area, substantial funds be made available for the development of health research in dentistry.
38. THAT, when appropriate, teaching hospitals and group medical programmes at health sciences centres develop comprehensive dental departments to provide dental clinical research opportunities.

39. THAT, in respect to nursing, centres be developed in Ontario for the training of nurses in research, as distinct from professional, job-oriented master's programmes.

X Research by Disciplines Allied to the Health Sciences

40. THAT, since many major advances in the health sciences have had their origin in basic biological discoveries, research in biology, social science, and agriculture, should be eligible for support by health agencies. Departments of universities engaged in social science, agricultural, or biological research, should be eligible for research grants from the Department of Health when the project is considered relevant to health research, within the terms of reference of the provincial role in health research.
41. THAT recognition be given to the importance of a comprehensive research programme on pollution, with priorities, and including a health research component. Universities should be encouraged to develop programmes of research into health problems related to pollution. Encouragement should be given to the expansion of Department of Health investigations into pollution.
42. THAT, in order to have a satisfactory overview on pollution and to develop sound policies for reducing their hazardous effects, we urge the appointment of an Environmental Quality Committee of the Ontario Council of Health, made up of informed and interested persons, charged to provide advice to Government on all matters related to pollution.

XI Role of Federal Agencies

43. THAT, taking into consideration Recommendations 44 and 45, the Province affirm the concept of allocation of federal resources for health research on the basis of national interest, and the general scheme of funding by federal agencies.
44. THAT, because of regional needs and specific community goals, and because of the continuing role of the Province in the interrelated areas of teaching, service, and research, the Province maintain a strong health research capability.
45. THAT, because of Recommendations 43 and 44 above, the mechanisms of co-ordination between provincial and federal

authorities be strengthened by appropriate provincial representatives on national bodies, and/or by the constitution of special committees for this purpose.

XII Health Care Research

46. THAT highest priority in the funding of health care research should go to:
 - a. research in end-results among patients who have received health care in experimental situations;
 - b. research in cost-effectiveness should be carried out using models, the validity of which has been established by end-results analyses.
47. THAT, while individuals' and health professionals' perceptions of need and actions are important indicators of health research priorities, "process" research should only be encouraged in areas where the effectiveness of the service programme under study in maintaining or improving health has been demonstrated.
48. THAT, since personnel skilled in the methods of epidemiology, biometrics, economics, and operations research, are required for end-results and cost-effectiveness research, high priority must be given by universities to the training of investigators in these methods.
49. THAT careful consideration should be given to the creation of a health services research capability, both in association with health sciences centres in Ontario universities and within government, which would combine the disciplines of epidemiology, biometrics, health economics, and operations research. There should be a capability to perform both independent and contract research, provide consultation services, and train additional health care research workers in these disciplines in these skills.
50. THAT, since biomedical research is inseparable from health care research, careful consideration should be given to the development of methods which facilitate information transfer between all areas of health research. Special support should be available for integrated programmes of health research which include both biomedical and health care components.

51. THAT, since universities and the Province share responsibility for assessing and developing university programmes in education and research relative to provincial health problems, universities, communities, and governmental departments, and particularly groups within these structures, should participate in an open exchange of policy views, information, and manpower.
52. THAT programmes to be supported by the Province, related to health educational and research facilities and experiments or demonstrations in health care programmes, should be assessed by competent groups prior to their initiation.
53. THAT innovations arising from health services and biomedical research should continuously influence health education. Therefore, health professional education must continue throughout the career of the learner, and must be responsive to both these innovations and to the total health services system. Support should be provided for realistic educational programmes in areas relevant to continuous education of health professionals, commencing at the beginning of health professional education.

Report of the Committee

REPORT

Introduction

The Committee on Health Research was given the following terms of reference by Council:

The Committee would advise on the co-ordination and development of the provincial effort in the field of health research.

In its deliberations, the Health Research Committee recognized that health research embraced a very broad spectrum of activity, encompassing all aspects of biomedical research, a part in developmental research, and health care research. The Committee also recognized that health research was an important component of health education and health service, and in most instances could not be separated from these. The Committee therefore consulted as broad a group of individuals as possible in order to obtain information and advice on all aspects of health research. The report contains the results of these discussions and represents the opinion of the Committee and not necessarily that of the consultants.

The underlying principle of the report is that health research is a continuum and that all aspects are central for the development of effective health care, health services, and health education programmes. The fragmentation of health research, caused in part by different administrative and support programmes, should be resolved, since it has resulted in underdeveloped areas of health research and has made it difficult to establish priorities. In order to establish priorities for both extramural and intramural research, there is a need

for an overall health research committee. The standards for health research should be the same in all areas. Because the Province has responsibilities in health care and health education, it is necessary that the Province ensure that health research should develop so as to be effective in respect to these.

The Committee considered that the economics of health research is an important topic. Effective health research programmes could be important in assessing the value of proposed health care and health service programmes. The question which could not be answered was what proportion of the expenditure on health should be in health research so that effective use of resources can be made. The Committee could find no valid information available on this point, in this or other countries. The new Committee on Health Research intends to pursue this important topic and submit a report in the future.

SECTION I

General Policy

In examining this problem, some concept of what health research encompasses is necessary.

The Royal Commission on Health Services considered Health Research in the following manner:

In this age of quickening scientific advance, health related research draws upon many fields of science and many disciplines within each field. Within this broad context, the term 'health research' rather than the traditional expression 'medical research' is more fully expressive of the aims and efforts of our scientists to improve the mental and physical well-being of Canadians in particular and of mankind in general.

More specifically, health research may be defined as:

. . . all systematic study directed toward the development and use of scientific knowledge through fundamental research in the laboratory, clinical investigations, clinical trials, epidemiological studies and engineering studies in the following areas:

- 1. The causes, diagnosis, treatment, control, prevention of, and rehabilitation relating to the physical and mental diseases and other killing and crippling impairments of mankind;*
- 2. The origin, nature, and solution of health problems not identifiable in terms of disease entities;*

3. *Broad fields of science where the research is undertaken to obtain an understanding of processes affecting disease and human well-being;*
4. *Research in nutritional problems impairing, contributing to, or otherwise affecting optimum health;*
5. *Development of improved methods, techniques, and equipment for research, diagnosis, therapy and rehabilitation.*

For our purposes it is necessary to extend this definition to include studies directed towards determining quantitatively or qualitatively the progress made in achieving the goals of a health services programme. Any systematic appraisal of a health programme requires not only those statistics that measure the volume of health care, it also requires the assessment of its goals in terms of the changing health needs of the community. In view of the Health Services Programmes we have recommended, our definition of health research must include much more than has generally been included if Canadians are to obtain the best health care possible.

Health research therefore can be defined in terms of studies related to the total spectrum of health problems, which range from fundamental research such as that directed at ascertaining how the nucleus of the cell works, to operational research related to the efficacy of nursing care in a hospital.

The Provincial Role in Health Research should be the provision of the facilities and resources necessary to achieve an integrated operation in respect to the pursuit of fundamental knowledge, and the application of this knowledge in the improvement of health, in the management of disease in the community, and in the assessment of the efficacy of health care. The Province should ensure that the universities and other organizations have sufficient resources to provide a smooth interplay between the activities of education and research, and the application of these activities in health care and continuing education.

In determining the extent of the provincial role in health research, it is necessary to consider the function of the University Health Sciences Centres, a comparatively recent development on Ontario campuses. These centres, which are designed to encompass

health facilities at the university, such as medicine, dentistry, pharmacy, nursing, and others, have arisen because of the recognition by university and government of the need for better integration in these areas. What is, or should be, the role of these centres within the university setting?

The university has traditionally been the centre for teaching and research. In science it has become increasingly apparent that the words 'teaching and research' are not adequate to define the proper function of individuals in a university. The primary functions of the university are education and acquisition of knowledge. To make education effective, knowledge is essential.

A professor learns by his experience, which in science essentially means his study of problems. The student learns by his exposure to problems of a more controlled type which the professor prepares for him. They are both learning, however, by solving problems. Thus the phrase 'centres of learning' more accurately describes the function of the Health Sciences Centre today than the words 'teaching and research.' Use of this phrase allows us to get away from the misconception that teaching and research are opposed or in competition. It allows us to recognize that learning is a function which involves dissemination of information in the form of problems to students, and the professor studying problems of a more complex nature which his own experience puts him in a position to examine.

Too often one hears debates centred about concepts such as teaching versus research, or pure research versus applied research. Many university authorities have considered that the efficiency of their operation can be best maintained by dividing the university operations into several activities, one of which is teaching, another research. More recently the university has come to recognize a third function, service to the community in a regional setting, and the important effect that this service has upon research and teaching. Although universities have become aware of their service responsibilities, they have been concerned that this would divert energy and resources from teaching and research. Whenever possible, the universities should be encouraged to co-operate with, and when possible, take part in, health research programmes which are initiated by groups outside the university jurisdiction.

It is the opinion of this Committee that apparent separation must not be allowed to affect the necessary integration of research, education, and service. Research today has a major impact on

education and service, and these have major impact on research. To try and divide them is to fragment the whole concept of education and to make it less meaningful for present society. The committee has tried to define the provincial role in health research in relation to these various problems.

A clear recognition of this situation by universities, the community, and government, would assist materially in relieving the continuing tensions within the university and community, namely teaching versus research, pure research versus applied research and, more important, the sciences versus the arts.

Forces Operating in Society which Affect the Functions of the University, Developments in the Community and the Government.

The changes in the above functions are being affected by forces operating within our society. There are three general areas:

1. There is an exponential growth of knowledge at the present moment which shows no signs of levelling off. It is not important to dwell upon the pace or volume of this increase, but to consider its effects; that is, the changing balance between science and art. Historically, art has preceded science as a skill and has developed by experience and not by theory. The accumulation of knowledge has been slow, often developing independent of skills and at other times developing in response to needs for more and better skills. For most of his recorded history, man has had more skill than knowledge, that is more art than science. However, the rapid expansion of knowledge in this century has changed this balance, and now in many areas science has caught up with art and in some fields has actually surpassed it. Indeed in some areas of medicine we are in a position that we now know more than we practise. When a more even balance is achieved between science and art, a mutually interacting relationship can be established and the lines of demarcation between them can become less distinct.
2. A second force operating in our society is the demand for a decrease in the period of time between the discovery of knowledge and its application in practice. There used to be an interval of many decades between the discoveries of science and the use of that knowledge in health care. Today, discovery of a new drug in the laboratory often results in its use in medical

practice as fast as the safety of patients permits, sometimes even too quickly. However, there are other areas in which a considerable gap remains between the acquisition of knowledge and its application in society.

3. The increasing sophistication of the public, as a result of its education and exposure to the results of scientific achievements, has made it aware of the importance of knowledge in handling problems in society. This situation is now also well recognized by government. The university, because it has produced knowledge and applied it to skills, is expected to produce more and more of both of these commodities in shorter and shorter time periods. Traditionally, members of universities were concerned primarily with knowledge and very little concerned with the practising art. Today, the professor is expected to be both knower and doer. Nowhere is this problem better demonstrated than in the recent development of Health Sciences Centres. These centres have arisen because of the recognition by the universities and government of the need for integration of health research, health care, and the education of professional manpower.

The university health sciences centres, community and government, must be concerned with both the acquisition of knowledge and the application of knowledge so acquired. The latter can be achieved in two ways. One is to educate knowers and doers who, with knowledge and skill, will be distinguished future practitioners in the professions, and the other is to encourage investigators to attempt to solve the problems of society, thus advancing the public good.

If the universities, communities and the governments accept this philosophy there would be three direct benefits. First, we could cease to apologize for, or to rationalize as learning, the services that the university renders. Secondly, it would make it much more respectable than it now is to direct one's research efforts to questions of skill and not to confine them to questions of knowledge. For instance, it would be as intellectually acceptable to investigate how to deliver optimal health care to the public as to investigate the behaviour of the components of the living cell. It would be as commendable to study the effectiveness and costs of social workers as to investigate the mores of primitive people. Thirdly, it would make research proposals originating from groups outside the university more acceptable, and could lead to a better integration between universities, communities, and government health research pro-

grammes. This change in the character and the activity of these groups also requires re-examination of the methods used to finance their operation.

The Integration of Academic, Administrative, and Financial Operations in Health Research

The development of an effective health research program will require the efficient integration of the academic, administrative, and financial operations involved in health research. In the Province of Ontario, as elsewhere in Canada, present methods of financing result in little or no integration among the agencies which control the health and hospital programs, and the financing and development of health research. In many of the institutions providing health care, the individuals responsible for their operation are often ignorant of health research and how it affects the delivery of health care in the community.

We have, therefore, the interesting situation that the agency with the most to gain from the results of health research has been administratively remote from such research. Thus, while health research is a single activity, its operation is fragmented and poorly co-ordinated. Therefore one finds a situation in which there is no effective method for seeing that the knowledge obtained from expenditures on fundamental research is exploited in its applied aspects, that is, to ensure that it is used in the maintenance of health in the community.

It appears fundamental that a rapprochement between the health research activity and the health services be achieved as soon as possible. It is worth noting that in the United States, in 1965, federal legislation was passed to place in the hands of its health research agency (NIH), authority and funds for the purposes of graduate training of physicians in important disease areas and the expansion of clinical research in order to bring health research closer to the problems found in the practice of medicine. In Canada, health care is primarily a provincial responsibility. There is no set rule in respect to the support of health research. However, by custom, health research has been supported primarily from federal agencies.

Although support in this last area is still inadequate, some improvement has been noticeable in recent years. However, comparatively, research in the areas closely related to health care, can only be described as modest.

There are many difficulties in creating the proper integration and balance necessary to achieve the objectives proposed in the above discussion. However, it is apparent that unless the economic resources of the universities, communities, and governments, are sufficient to achieve a smooth integration in development of these areas, it will be virtually impossible to provide the opportunity to achieve the objectives proposed. It is therefore important to avoid the problems created by improper funding. *It is desirable that we examine the proper relationship among research, education, and service. The executive process must take into account the interests of the whole rather than any particular part.*

Methods of financing which tend to dissociate the various functions of the health sciences centres, communities, and government groups, lead to difficulties and often preclude the proper integration so necessary today.

In view of the foregoing it is recommended:

1. *THAT the following definition be considered as the Provincial Role in Health Research: "The provision of the facilities and resources necessary, in addition to those from federal and other sources, to achieve an integrated operation in respect to the pursuit of fundamental knowledge, and the application of this knowledge in the improvement of health, in the management of disease in the community, and in the assessment of the efficacy of health care."*
2. *THAT, as a basis for determining funds for health research, allocations be considered in relation to the needs of health care programmes.*
3. *THAT, subject to Recommendation 1, provincial support ensure that the universities, communities, and government groups, have sufficient resources to provide a smooth interplay among the activities of education, research, and service.*
4. *THAT the Ontario Council of Health act as an advisory body through its committees to make appropriate recommendations in respect to the implementation of Recommendations 1, 2 and 3 above.*

5. THAT the allocation of all funds for health research by the Province be made on the recommendation of a representative review committee which has had the opportunity of appraising such arrangements for funds in the light of provincial needs, such a representative committee to report to the Ontario Council of Health, and Council in turn to advise the Minister on this matter.

SECTION II

Financing of Health Research

GENERAL

The case for the prosecution of health research, particularly in a Health Sciences Centre, has been argued in Section I of this Report. A Health Sciences Centre is responsible for education (undergraduate, postgraduate and graduate teaching), diagnostic service, patient care, and research (fundamental and applied, including clinical investigation). According to circumstances, the following fields of study, in addition to Medicine, may be incorporated into such a centre: Dentistry, Nursing, Pharmacy, and many other allied disciplines. In such a complex centre, education, patient care, and research should be completely integrated. A separation of each of the three functions cannot be justified. This is recognized by the fact that, in Ontario, the new Health Sciences Centres have received financial support for capital development from three agencies—the Department of University Affairs, the Ontario Hospital Services Commission, and the Department of Health.

The Government of Ontario is responsible for the provision of modern health care of high standard for the people of the province. To do this it must assume the responsibility for the advancement of knowledge in the health sciences through the provision of facilities for research. It is also responsible for the training of health science personnel in sufficient quantity and quality to provide modern health care of high standards. If the programme is to be successful, sufficient funds must be available for (1) Construction of the necessary physical facilities and provision of capital equipment

(*Capital Funds*), (2) Maintenance of the centres at maximum efficiency (*Operating Funds*), (3) Provision of salaries of persons working in the centres (*Personnel Support*), (4) Provision of funds for original investigation (*Research Support*), (5) Provision of *Research Equipment*, (6) *Support of Special Units or Groups* and (7) *Contract Research*.

(1) CAPITAL FUNDS

At present, capital funds for health research facilities are provided by the Province through the close association of the Department of University Affairs, the Department of Health, and the Ontario Hospital Services Commission. Integration has been achieved through the Senior Co-ordinating Committee. Matched funds are currently available from the Federal Government through the instrument of the Health Resources Fund.

Through the Health Resources Fund, the Province has supplied capital funds for the development of facilities for the health sciences on the campus of each of several universities in Ontario. These developments include, in different degrees, facilities for education, service, and research. The capital funds have been provided promptly and attempts have been made to keep administrative confusion to a minimum. But future problems already can be foreseen. The number and extent of projects now under consideration and serious study, particularly in the affiliated hospitals, make one question whether the present machinery will be adequate to handle the large and complex claims that will be presented in the foreseeable future. It is recommended:

6. *THAT, in the allocation of capital funds available from the Province for financing of health research, Recommendation 5 is applicable.*

(2) OPERATING FUNDS

The need to provide sufficient funds for the day-to-day operation of present facilities and those planned or under construction is incontestable. Section I of this Report contains three general recommendations concerning the financing of health research. In general, the argument is presented for the provision of sufficient funds to achieve an integration of pure with applied research, which is directed towards the improvement of health, the management of disease in the community, and the assessment of the efficacy of

health care. In addition, an integration of the activities of education, research, and service must be achieved.

It is further recommended that the Ontario Council of Health act as an advisory body, through its committees, to make appropriate recommendations in respect to the implementation of the three general recommendations referred to above (Recommendation 4).

Education is currently the responsibility of the Department of University Affairs, service the responsibility of the Ontario Hospital Services Commission, and research the responsibility of the Department of Health. As pointed out above, a collaboration has been implemented for the allocation of capital funds. In the allocation of operating funds, however, many problems still remain. For example, with the current system of formula financing implemented by the Department of University Affairs, there is evidence that universities with medical schools and dental schools are at a disadvantage because of their heavy commitments to health science. This is neither fair to the other disciplines within the university, which are made to feel that they are contributing materially to the cost of the health science facilities (“bleeding the universities white,” is a phrase often heard), nor is it fair to the health sciences themselves.

As pointed out elsewhere in this Report, personnel working in the health sciences have a triple responsibility. In addition to teaching at many levels (undergraduate, graduate and postgraduate), and undertaking meaningful research, as do faculty members in most university departments, they must provide for the care of patients and assume the responsibilities associated with such patient care. Clearly the special needs of a clinical teaching programme must be recognized by the provision of adequate operating funds. In the opinion of this Committee, adequate funds for this purpose are not now provided through the current Department of University Affairs formula.

Since education is the responsibility of the Department of University Affairs, service the responsibility of the Ontario Hospital Services Commission, and research the responsibility of the Department of Health, it is recommended:

7. THAT a mechanism be evolved for establishing continuing collaboration among the Department of University Affairs, the Ontario Hospital Services Commission, and the Department of Health, for the

*provision of operating funds for Health Sciences
Centres.*

Overhead

The large commitment of a university to a health sciences research programme brings out the fact that such a programme incurs considerable additional overhead costs to the institution, a problem not unique in a university committed to a large number of major research projects, and one of considerable magnitude when applied to health research.

In the report "Overhead in University Research" prepared for the Association of Universities and Colleges of Canada, Committee on the Sciences, Dr. G. de B. Robinson, Vice-President Research, University of Toronto, pointed out that in the fields of Natural and Medical Sciences indirect costs borne by universities for research projects sponsored by outside agencies amount to approximately 60-70% of the total salaries of all members of the faculties concerned.

The pressing need by universities for additional funds to support research programmes was recognized by the Bladen Commission on the "Financing of Higher Education in Canada" (1965). This Commission recommended:

- (1) That all Federal Government research grants to universities (from the National Research Council, the Medical Research Council, the Canada Council, the Defence Research Board, External Aid, Atomic Energy Control Board, the Departments of Fisheries, Labour, etc.) for operating expenses, and all fellowships tenable in a university (granted by these Government bodies) should carry with them a 30% supplement as an unconditional grant to the university.
- (2) That a general sustaining grant for research be paid to every university and that this grant be 10% of the aggregate salaries of the full-time academic staff.

Bladen recommendation (1) above, by relating overhead funds to be awarded to total grant support, favours a university with large and well developed research programmes. The recommendation has the disadvantage, however, that the income of a university would be related excessively to funds generated by a few large grantees, a

situation which this Committee considers unhealthy. Bladen recommendation (2), in addition to providing overhead support to a university with a well established health science research programme, would provide “seed” money for developing institutions.

These recommendations have been endorsed by the Association of Universities and Colleges of Canada, the Association of Canadian Medical Colleges, the Canadian Association of Graduate Schools, the Medical Research Council and the National Research Council. Implicit in this endorsement is the recognition by these bodies of the need for increased funds to meet overhead expenses for research projects carried out in Canadian universities. Nowhere is the need for such overhead expenses more acute than in the developing Health Sciences Centres in the Ontario universities. Other segments of a university do not have the unusual responsibilities of a clinical teaching programme, which are expensive. These include patient care, residency, interne and specialty training, in addition to undergraduate and graduate teaching and research common to most university departments.

It is apparent that, if the Bladen recommendations were implemented, the problem of overhead expenses in large measure would be resolved. Since there is little indication that the Federal Government plans to take action upon these recommendations, there still exists an urgent need, to which the Province should take heed.

The problem of overhead in health science research was discussed by the Committee with the Deans of Medicine, Ontario Medical Schools, and with the Vice-Presidents, Health Sciences. It was agreed that further funds are needed which should be added to, but kept quite distinct from, those made available to the university generally from the Department of University Affairs through formula financing. These could be provided in the form of an institutional grant to be administered by the Vice-President, Health Sciences, or his equivalent. It would be the responsibility of each institution to determine how the funds should be divided among departments, affiliated hospitals, central administration, and other central services such as library, computing centre, etc.

It is recommended:

8. THAT additional support, related to the aggregate salaries of the full-time academic staffs, be made available from Provincial funds to meet the overhead expenses in the Health Sciences Centres.

(3) PERSONNEL SUPPORT

The point has been made already that personnel working in the health sciences field have the three-fold responsibility of education, service, and research. Since these responsibilities are, or should be, closely integrated and at times indistinguishable, it is highly desirable that all such personnel, with the possible exception of the special case of persons or groups of outstanding merit (Section III), know that their basic salary is provided for through the same machinery. It is obviously of little consequence to a worker in a Health Sciences Centre whether the ultimate source of his income derives from funds made available by the Department of University Affairs, the Ontario Hospital Services Commission, the Department of Health, or, which is more likely, by a combination of all three, so long as he is aware that his income comes from the general budget of his institution. Having, for example, one group of workers paid directly from an organization whose sole responsibility is patient care, and, another group paid directly from an organization devoted exclusively to research, creates many difficulties, both practical and emotional.

At the present time some health science personnel are supported by voluntary agencies such as the National Cancer Institute, the National Heart Foundation (See Section IV). These agencies, very properly, have been flexible in the distribution of their funds and often have provided support for personnel, particularly in the area of applied and developmental research, in situations where much needed funds were not forthcoming from other sources. The goal should be that personnel supported in this way ultimately would be paid through the budget of the institution (as is the policy of many voluntary agencies). This would then free the funds of the agency for other new and experimental enterprises. It is a strength of a voluntary agency that it is less constrained, and hence it is able to initiate undertakings of enlightened imagination.

A point perhaps not generally recognized is the magnitude of the projected demand for funds for the support of health sciences personnel in Ontario. From a survey of the Deans and/or Vice-Presidents, Health Sciences, made by the Committee, the planned number of full-time staff to be supported from university funds will increase by a factor of two between the 1967-1968 and 1972-1973 academic years. For Toronto, Western, Queen's, and McMaster the figure will increase from 560 full-time staff in 1967-68, to 1,117 in

1972-73. These figures include staff supported solely from university funds.

They do not include staff supported through the voluntary agencies, Medical Research Council, O.H.S.C., university fund-sharing arrangements, or private practice.

At the present time, many future Health Services personnel are supported by the fellowship, scholarship or associateship programme of the Medical Research Council, and other personnel are supported through the instrument of the operating research grant. Other personnel are trained through schemes developed by the Provincial Department of Health and certain of the voluntary agencies. In Canada, with the exception of Quebec, there is no "Training Grant Programme" comparable to that established by the U.S. National Institutes of Health. The training of Health Services personnel is a matter of considerable urgency in Canada today. The problem is discussed in detail in Section VI of this Report.

It is recommended:

9. THAT all personnel (professional, technical and support) engaged upon health research, which is integrated closely with teaching or patient care, be financed through provincial funds identified with the institution.

(4) RESEARCH FUNDS

The point has been made many times in this Report that education, service, and research are inseparable. For this reason, the general operating budget of an institution engaged upon health science research should be adequate to provide basic research facilities, which should be equally available for needs related to teaching and the care of patients.

In addition to this, however, further funds, competed for nationally, should be available for project-oriented research. At the present time, the Medical Research Council, and to a lesser degree the National Research Council and the Federal Department of Health and Welfare, provide funds for research in the health sciences on the basis of merit. These funds permit the payment of salaries for personnel employed on the project (excluding that of the grantee) and may include allocations for supplies, equipment and travel. The

funds are usually awarded to a scientist on application. The request is referred on a national basis and a grant is made strictly on the merit of the application. A recommendation for support is made by a panel of scientists knowledgeable in the field, who usually consult outside referees who are experts on the detailed topic of the proposed research. To a lesser degree, funds for research also are made available by the voluntary agencies on a similar basis (see Section IV). In general, the funds currently available are inadequate, and the policies of the granting bodies are such that certain areas important to health research are not covered, notably operational, epidemiological and developmental health research, and research projects involving education, training, and patient care.

Although funding on a national merit basis has numerous advantages, and should be continued, such policies may create serious difficulties at the Provincial and Health Sciences Centre level. Because of the current shortage of such funds, many members of the staff may receive no or inadequate project-oriented research support even though they may have the potential to undertake competent research programmes. At the moment, if no support is forthcoming from federal grants, it is difficult or impossible to obtain such support from other sources. Yet, many of such personnel may be performing an excellent service in the Health Sciences Centre and may play key roles in its operation. Some research support could be justified in this case, since—

1. a competent ongoing research programme will improve the quality of the staff members' other functions, particularly in the area of both graduate and undergraduate teaching.
2. without research funds, the staff member will become dissatisfied and either leave or tend to perform his other duties perfunctorily.

The national granting bodies recognize this problem to some extent and attempt to spread their funds a little more widely than a strict merit system would justify. However, a more rational solution would be to allow the federal agencies to adopt a rigid merit system, and then to offer sufficient research support to the Health Sciences Centre to allow the remaining and perhaps larger fraction of the staff to carry out a research programme on a more modest basis. The funds for the latter programme could come from a provincial-federal sharing scheme.

It should be the role of the Province to keep the policies and procedures of the federal funding agencies and those of the voluntary agencies under close scrutiny. If the provincial policy continues to remain flexible, the health research needs of Ontario can be well served.

Recently, the Department of Health of the Province of Ontario has established a research grant programme in the health sciences which will concentrate on those areas of health research that are inadequately provided for by other funding agencies. Again, funds are made available to an applicant strictly on the basis of the merit of the project as judged by a committee of scientists, who usually consult outside expert referees. The programme complements that of the federal agencies and provides support of a similar type in areas where research support is urgently needed. It is recommended:

10. THAT the Province maintain a flexible research support programme which complements existing programmes.

11. THAT, in order to maintain an effective professional staff in Health Sciences Centres, an additional funding mechanism be developed to support a research activity which is essential for the education and service activities of the institution.

(5) RESEARCH EQUIPMENT

Research in the health sciences needs a variety of resources including costly sophisticated equipment. Once a research laboratory has been constructed (i.e., the necessary capital funds have been provided, and the necessary operating funds have been made available, and highly trained personnel engaged), the laboratory can function effectively only if a variety of complex research equipment has been acquired. This equipment generally is of two types: (a) basic multipurpose equipment, necessary for teaching commitments and patient care, in addition to research, and (b) specialized, more complex and often more costly, equipment necessary for the prosecution of specific research projects. The nature of the latter will depend to a large extent upon the interests and the competence of the senior scientists appointed to the laboratory.

In an established laboratory the basic equipment usually has been acquired by the university, hospital or group over a period of years.

It is regarded as a necessary part of the overall installation and may be used, as the occasion arises, for teaching, the care of patients, or research. The more specialized equipment, which is project-oriented, is usually provided by some outside funding agency, as are the research funds discussed in (4) above. At the present time, the Medical Research Council, and to a lesser degree the National Research Council, the Department of National Health and Welfare, and the voluntary agencies, provide such funds. As for the operating grants, these equipment grants are awarded on application, usually in national competition. The grant is made on the recommendation of a panel of experts. Again, in areas of research not covered by the policies of the national funding agencies, grants for equipment may be applied for from the Ontario Department of Health on a similar basis.

Such policies as described above appear to be working well for established groups, although there are complaints that the funds available are insufficient. For new units, or for established units which have been moved into new or renovated space, the situation is, however, critical. According to present federal policies, basic equipment for such units must be financed by the Province and the Health Resources Fund. Such a ruling applies to all projects supported through the Health Resources Fund, from the time a construction contract is let until 18 months after the new building is completed. This necessitates the establishment of an adequate provincial review machinery to process requests for the equipping of laboratories established under Health Resources Fund auspices. In Ontario, such a review procedure has been established by the Senior Co-ordinating Committee.

However, difficulties have arisen, since the federal commitments have been made before policy governing the use of funds and co-ordination with other agencies has been established. For example, workers in new laboratories or in established laboratories relocated in new or renovated space under the auspices of the Health Resources Fund, are ineligible to apply to the Medical Research Council for the more specialized project-oriented equipment which is necessary for their work. Such ineligibility may extend over a period of three to four years. In many instances this gap is creating genuine hardship. It is hampering greatly the very necessary development of the Health Sciences Centres in the province.

The Provincial Department of Health should continue to make known to the provincial and federal authorities the need to eliminate

discontinuity in the provision of support for research equipment. It is recommended:

12. THAT application for funds for basic multi-purpose equipment or for the more specialized project-oriented equipment be received and awards made as required, and be considered as a whole.

A problem in the provincial funding mechanism can also be identified. Each of the Health Sciences Centres has submitted an estimate of its equipment requirements in its original request for funds. However, it is apparent that many of the original estimates for equipment are or will be seriously out-of-line in respect to true needs at the actual time of implementation, because of a combination of the following factors:

- (1) inadequate planning on the part of the universities;
- (2) inadequate communication between governments and universities;
- (3) changes in policies of government agencies (in particular, the Medical Research Council);
- (4) inadequate information about the needs of future staff when the building was planned; and
- (5) changes in needs and costs of equipment.

It is apparent to the Committee that the recruitment of competent staff for Health Sciences Centres is seriously threatened if funds cannot be provided for reasonable requests to install the initial start-up equipment for the new teacher/scientists.

The present mechanism for reviewing equipment requests means that the institutions concerned have to prepare a programme and show how their equipment request relates to this programme. In addition, it is incorrect to provide funds for equipment not directly related to an individual or identified need. This means that funding has to be done in a flexible, progressive manner as the recruitment of staff evolves. In this context, of course, an institution can provide an approximate estimate of need which should, with imaginative planning, be reasonably close to its true need.

Even if adequate planning has been carried out, however, the fluctuations in recruitment of staff will create peaks and valleys in terms of the demands. This, together with other changes, may cause estimates to be inaccurate at the time of final implementation. It is important, if careful planning is to be carried out, that governments are in the position to provide resources through flexible funding mechanism.

(6) SUPPORT FOR SPECIAL UNITS OR GROUPS

It is generally agreed that special units or groups have a place in health research in the Province of Ontario. This topic is considered in detail in Section III.

(7) CONTRACT RESEARCH

The Committee recognizes that the government and its health agencies will from time to time identify areas in which information about a particular problem is essential if informed decisions are to be made. This will require the initiation of research, by specially qualified individuals, usually through the form of a negotiated contract. The Committee believes that the same standard should apply to this form of research as that initiated by other mechanisms. The high priority and needs of government in respect to the proposal would, of course, be taken into consideration. There is no room, however, for two standards in research. The committee recommends:

13. THAT proposals for contract health research initiated by agencies of the Provincial Government be reviewed by the Health Research Committee of the Ontario Council of Health, and recommendations made in respect to the scientific merit of the proposal and the method of study.

SECTION III

Special Groups of Outstanding Merit

*In a world that is rocking with change we need more than anything else a high capacity for adjustment to changed circumstances, a capacity for innovation.**

The recent development of Health Sciences Centres on many university campuses in Ontario augurs well for the future of health care in this province. These centres should provide the focus and the impetus for a co-ordinated and integrated approach to the myriad problems of health research, education and service. This concept has been recognized by the universities and by government and greatly increased support has been made available on a broad front to meet the projected needs for such centres. Such support, particularly in respect to personnel and their requirements, must continue to be developed to ensure the buildup of various centres into efficient functioning units and to ensure that, once created, the centres will not falter. The ultimate success of these ventures will depend very much on the competence of the personnel in them, and on imaginative and efficient planning in the development of the centre.

Excellence in the health sciences centres, as exemplified by a high capacity for imagination, uniqueness, and innovation, is the *sine qua non* for excellence in health care.

It is the opinion of the Committee that years of impoverishment in the medical schools and in other branches of the Health Sciences,

* *Excellence*, by John W. Gardner, Harper and Rowe, New York, 1961.

and years of lack of understanding by government and others of the real needs of the Health Sciences, have left serious lacunae in many aspects of our training programmes. Many potential leaders have left the country, many others have floundered in their development due to lack of support and encouragement, and it has been difficult to attract competent people from outside the country. Although the atmosphere has changed immeasurably in recent years, it will be several years before the problems resulting from the errors of the past can be fully rectified. Thus, the present leaders in the Health Sciences Centres are faced with a major rebuilding task.

In spite of the difficulties just described, this rebuilding programme is already under way and one can confidently expect that within a few years, if support continues to meet the real needs, the Health Sciences Centres, staffed with competent people, will be better able to fulfil their role in health research, education, and service in the Province of Ontario.

However, it should be recognized that competence operates at more than one level, and that there is an outstanding requirement for competence of one particular kind, that is for individuals with a high capacity for innovation.

In today's Health Sciences Centres, growth is being stimulated by the practical needs of the present, so that plans for recruitment, teaching, and service are related to immediate problems. Although such *ad hoc* solutions are probably inevitable, such policies tend to inhibit innovation and mortgage our future. In order to minimize the need for *ad hoc* decisions and the problems which they generate, it is self-evident that Medical Schools and Health Sciences Centres should continuously be organizing and planning programmes of teaching, research, and service designed to the needs of the future. In order to achieve this, one needs in the schools, a high capacity for change and adaptation. By definition, such qualities are most readily found in men and women of exceptional ability.

The need for, and usefulness of, exceptional quality extends in several directions. Although these individuals will constitute a small minority of the total population in the centre, their worth is far out of proportion to their number. Simply by their presence, they will raise the general calibre of research, teaching and service. They will provide the spearhead for innovation and for the undertaking of new tasks. They will supply the major driving force for the centre. Excellence breeds excellence and communicates itself to others.

Persons of superior ability bring with them high standards in all aspects of intellectual behaviour, and their colleagues cannot help but consider their own efforts in this context. Outstanding merit also generates another investment in the future, for it is in this atmosphere that one trains those leaders who will lead in the health field 10-20 years from now.

The establishment of groups of outstanding ability is probably one of the most challenging tasks facing those charged with the development of the health sciences in Ontario. It should be emphasized that support for such groups is also a national and international problem and Ontario should assume some responsibility in providing a unique resource not available, or rarely available, anywhere else. In addition, the existence of such groups is intimately related to the achievement of the highest standards of health services in the province. For these reasons, the Government of Ontario should initiate policies to identify individuals of outstanding excellence and to develop effective mechanisms for their support.

It is difficult to describe such people precisely, but they are individuals whose ability is recognized widely, and internationally, and who, by their presence, will attract people to the centre and will seriously affect the total effort of that centre. In addition, the centres themselves must be given the means to recruit such individuals. The onus for developing unique groups should, of course, rest with the universities or Health Sciences Centres. But, with the increasing pressure for expansion of educational output and service, for egalitarianism, and for formula-based financing, and with the increasing necessity for a high degree of sophistication in more and more areas of the health sciences, it will be tempting for the centres to utilize their limited resources to meet their more immediate needs. By their very nature, however, the needs of individuals with exceptional competence cannot usually be met in this context. For them, it is important *that unique mechanisms be developed*, both for their recognition and for their support.

When this type of support is considered in the light of its effects on the community as well as on the Health Sciences Centres, it should be recognized that, since the number of such individuals will be relatively small, the cost is relatively meagre. Such support should be of the extraordinary kind and not be made available at the expense of others in the Health Sciences Centres and university. For "We must seek excellence in a context of concern for all."

This support must be made available fairly soon. The Health Sciences Centres are now undergoing their most rapid expansion, and only the availability of special sources of support will enable these centres to fill some of their positions with individuals or groups of truly outstanding calibre.

In view of the foregoing considerations it is recommended:

14. THAT the needs, in respect to resources and personnel for special groups in health research, warrant the reiteration that Recommendation 5 covers the provincial need in this area.

SECTION IV

The Role of Voluntary Health Agencies in Provincial Health Research

Leaders in the community have long understood that society has a major responsibility in the development of a comprehensive approach to the multi-faceted problems of research in health care. Attempts to meet this challenge have been made by direct means, through voluntary health agencies, and by indirect means, through tax-supported government sources.

The voluntary health agencies play a unique role in the development of programmes on a broad front to meet the health requirements of a very rapidly changing society. Their importance is perhaps best expressed in the following statement, which is equally applicable to Canada.

*Voluntary health and welfare agencies in the United States have been a principal means for raising the level of society's well-being by channeling into effective action the energies and good will of countless American contributors, volunteers, officers and staff members. The agencies have thus been in a position to provide needed services, develop and pioneer new methods, and make major contributions to the improvement of the health and welfare of the American people.**

The objectives of the many different private groups differ in some respect but, in general, they are all concerned with improvement

* An exploratory study by an Ad Hoc Citizen Committee, "Voluntary Health and Welfare Agencies in the United States," the Schoolmasters' Press, New York, 1961, p.1.

in various aspects of health education, service and research. Although all of these aims are closely inter-related, we shall be concerned here principally with the role of the health agencies in research and training.

Nature of the Voluntary Health Agencies

For the purpose of this report, we have defined a voluntary health agency as a non-profit organization, dependent for most of its funds on donations from the public, and dedicated to the solution of a specific health problem.

The three groups most active in the support of health research in Ontario which fall within this definition are the National Cancer Institute of Canada, the Canadian Arthritis and Rheumatism Society, and the Canadian Heart Foundation. All of these organizations operate on a national scale, but naturally provide extensive support for health research and training in Ontario. In spite of the concern of each of the voluntary health agencies with a specific disease, their overall objectives overlap in many ways and can be summarized as follows:

1. To promote research activities in the fields of cancer, heart, and rheumatic diseases. The agencies recognize that many fundamental studies in biology impinge on each of their specific objectives, and more or less of their support is directed in this latter direction.
2. To improve and to aid in the training of scientists who will be specialists in the health area of interest to the agency. It is recognized that the research activities mentioned under (1) are an invaluable asset to the improvement of medical education and the development of trained personnel.
3. To create, or help to create, units, or groups, which will carry out research, teaching and service in their area of health care.

In addition to these activities the voluntary health agencies play an important role in assessing and disseminating information and in helping to operate clinics and allied services.

Extent of Support

The grant-in-aid and fellowship programmes are a common feature of

all voluntary health agencies. These programmes are operated with the aid of scientific advisory boards, and the funds are disbursed on the basis of merit and, to a large extent, on the orientation of the research to the disease in question. The voluntary agencies differ in this respect from the major governmental agencies where support covers (or should cover) the whole spectrum of the health sciences.

The extent of support from these agencies varies greatly. For example, in 1967, the National Cancer Institute of Canada spent \$1,360,000 in Ontario, the Canadian Heart Foundation \$1,124,000, and the Canadian Arthritis and Rheumatism Society \$400,000. It should be re-emphasized, that these funds in large measure are raised by voluntary donations.

The Unique Role of the Voluntary Health Agencies

Since, by definition, the voluntary health agencies are dedicated to improvements in particular aspects of health care, their efforts are directed mainly in these specific directions. However, the spin-off from research in one specific area of health care may extend into various other areas of disease problems, and into the whole gamut of the health sciences. It is recognized by the agencies that their resources will often fall far short of the necessary task and that additional support in these fields is required from governmental agencies. Because of this situation, and because of the relative freedom of action associated with the private nature of their organizations, the voluntary agencies have been able to develop unique programmes for support of health research and training. The history of the National Cancer Institute of Canada perhaps provides the best example in this regard.

“This Institute was the first organization supporting medical full-time positions in Universities, the first to create the type of position now called a Research Scholarship, and the first to establish research units on the campuses of several Universities. Recognizing a special need for support for radiobiological research the Institute, until fairly recently, was the largest source of support for extramural research in this field. The Institute was also among the first to organize a regular series of research conferences; and the ‘Honey Harbour’ conferences, as they are known, have won an international reputation for excellence.”*

* From brief submitted to the McDonald Committee by the Board of Directors of the National Cancer Institute of Canada—Appendix in Annual Report, 1967-68.

The Canadian Arthritis and Rheumatism Society specifically states that: "The Society's policy is to provide directly only those services which cannot be better provided by other institutions or agencies or which they cannot or will not provide themselves."*

And the "Canadian Heart Foundation has maintained a degree of flexibility to meet emergency situations that may be denied the larger official agencies of government."**

The private agencies have shown that they are ideally suited to the identification of specific needs in certain areas, and that they are able to provide support quickly.

This has been particularly noticeable in fellowship training programmes, where much stimulus and effort was, and is, needed, and where all of the agencies have done an excellent job. Although, again, the governmental agencies have now recognized deficiencies in this field, it is probable that in the future new needs will arise, and it may be difficult to reorganize existing administrative procedures to deal with them with sufficient promptness. The voluntary health agencies, however, have shown in the past that they can act flexibly and fulfil this function admirably.

Similar considerations apply to research, as well. The development of original and comprehensive science programmes requires that important areas and imaginative scientists be recognized early, and that they receive adequate support *at that time*. The administrative procedures of most governmental agencies, however, are designed to meet the needs of the total community, and such agencies will therefore be reluctant to offer extraordinary support to essentially untried people and untried programmes. The voluntary health agencies fill this breach.

In addition, the voluntary health agencies have been able to provide an alternative source of support to the research scientist. With the expansion in health care, and the escalation in costs, the major burden of support in the future may well have to come from governmental sources. In fact, this position has already been reached in the United States. The ultimate result of such a development will

* From the 17th Annual Report of the Canadian Arthritis and Rheumatism Society, 1965.

** From the Report of Medical Advisory Committee in the Canadian Heart Foundation Annual Report, 1967.

be that the research scientist will have to depend for his support on one health agency, and will be subject to the policies of that agency, right or wrong. The availability of progressive and well endowed voluntary agencies provides an important alternative to him and may, in fact, allow some departure from "current fashions" in science.

Finally, it should be recognized that it is generally difficult to attract first-rate scientists to disease-oriented research. The development of knowledge in such areas of research is such that application of the most critical approaches and techniques is often difficult. However, at the same time, it is important that the world of the so-called "basic" biologist and the world of disease be bridged. By adopting progressive policies of education and support, the voluntary agencies are meeting this challenge and are drawing more and more excellent scientists to important problems in health care.

In addition, because of their unique position, the voluntary agencies must be responsive to both the scientific community and the general public. They, therefore, serve as a bridge between these two groups. In effect, the private agencies stimulate extensive involvement and participation by the public in health research, an important facet of the development of comprehensive health care programmes in the Province of Ontario.

In summary, the voluntary health agencies provide a useful and unique instrument for the advancement of the health sciences. "They have the capacity to move swiftly, flexibly, and imaginatively into a new area of critical need; the power to arrive at a disinterested, objective appraisal of a situation free of political influence; the freedom to engage in controversial activities; the ability to experiment in an unfettered manner—and if need be fail; and finally, the capacity for sympathetic personal attention to the variety of human problems that beset our increasingly dehumanized world."*

The above discussion illustrates clearly the particular and important role that the voluntary agencies have played in the health-care field in Ontario.

It is recommended:

15. THAT, because of the important and unique role

* "The Nongovernmental Organization at Bay," p.7, from the Annual Report of the Carnegie Corporation of New York (1966).

played by the voluntary agencies, these agencies should be actively encouraged to continue to expand their activities. It is further recommended that, when a particular activity of the agency becomes part of the health care programme, the funding for this activity be provided on a continuing basis.

SECTION V

Existing Provincial Support for Health Research

In the past, Provincial support for Health Research has been difficult to identify because until 1968-69 funds for the support of research were not separated as such in the Annual Estimates for the Department of Health. For the first time in 1968-69, and again in 1969-70, funds for the support of research, as opposed to other health programmes, were itemized separately in the Estimates. This practice followed the creation of the Ontario Council of Health, with a Committee on Health Research, and the establishment of an effective Research and Planning Branch within the Department of Health. Table I shows the Provincial Estimates of Expenditures for Health Research for these two years.

It can readily be seen that most of the funds made available for Health Research were allocated to four Ontario Foundations: Alcoholism and Drug Addiction Research Foundation, Ontario Cancer Treatment and Research Foundation, Ontario Mental Health Foundation, Ontario Heart Foundation. In addition, in each of the two years a further \$1,250,000 was made available for new research programmes. This sum includes the funds necessary to maintain the Provincial Research Grant Programme in the Health Sciences, initiated in 1968. Table I shows that for the past several years in excess of \$3,000,000 has been allocated annually to the above four Ontario Foundations. This has been and still is the major component in the support of Health Research by the Province of Ontario.

The provincial funds allocated for the support of research administered by these Foundations represent, however, only a small

TABLE I
PROVINCIAL SUPPORT OF HEALTH RESEARCH

	1968-69	1969-70
Alcoholism and Drug Addiction Research Foundation	\$ 634,000	\$ 759,700
Ontario Cancer Treatment and Research Foundation	1,537,000	1,600,000
Ontario Mental Health Foundation	750,000	800,000
Ontario Heart Foundation	150,000	150,000
New Research Programmes	1,250,000	1,250,000
	\$4,321,000	\$4,559,700

TABLE II
PROVINCIAL SUPPORT OF NON-RESEARCH COMPONENT OF PROGRAMMES OF FOUNDATIONS THAT ALSO ADMINISTER HEALTH RESEARCH PROGRAMMES

	1968-69	1969-70
Alcoholism and Drug Addiction Research Foundation	\$5,566,000	\$6,566,000
Ontario Cancer Treatment and Research Foundation	1,300,000	1,400,000
Ontario Mental Health Foundation	270,000	270,000
	\$7,136,000	\$8,236,000

TABLE III
ANNUAL EXPENDITURE ON RESEARCH BY FOUR ONTARIO FOUNDATIONS

	1966-67	1967-68	1968-69
Alcoholism and Drug Addiction Research Foundation	\$ 617,000	\$ 600,000 (est.)	\$ 760,000 (est.)
Ontario Cancer Treatment and Research Foundation	1,306,589	1,332,741	1,562,467
Ontario Mental Health Foundation	662,258	819,664	942,096
Ontario Heart Foundation	934,963	957,678	1,180,000 (est.)

percentage of the total funds made available to the Foundations from provincial sources. The Foundations all have administrative programmes and in most instances they are responsible for the provision of health services in the special area of their interest. With the exception of the Ontario Heart Foundation, a voluntary agency which raises its own funds by public campaigns, the Foundations all receive provincial funds additional to those earmarked for research and shown in Table I. The extent of this non-research support for 1968-69 and 1969-70 is shown in Table II.

The picture is further complicated by the fact that the four Foundations represented in Table I have other sources of income, such as grants from the Federal Department of Health and Welfare, bequests, income from public donations and campaigns, interest on investments, and grants from other agencies (Canadian and American). For this reason, it is possible that the amount spent by a Foundation in any given year for the support of research will in fact exceed the funds shown in Table I. Comparative figures are difficult to obtain because of differences in accounting methods. Table III shows the annual expenditure on research by each of the four Foundations for the years 1966-67, 1967-68, and 1968-69.

Each of the four Foundations will now be discussed separately, for each of them is distinctive, the one feature common to all being that they receive financial support from the Provincial Department of Health specifically for the financing of Health Research programmes.

Alcoholism and Drug Addiction Research Foundation

The Alcoholism and Drug Addiction Research Foundation is a provincial body empowered under *The Alcoholism and Drug Addiction Foundation Act, 1965*, to conduct and promote a programme of research in alcoholism and drug addiction; to conduct, direct, and promote programmes for treatment and rehabilitation as well as experimentation in methods of treatment and rehabilitation of alcoholics and addicts. The Foundation initially received its charter in 1949 as the Alcoholism Research Foundation.

The Foundation is presently engaged in programmes of clinical, biological, physiological, and sociological research, both within its own institutions and in a variety of hospitals and universities. It is assisted by a Professional Advisory Board. All research grant

applications are reviewed by the Board, which forwards its recommendations to the Foundation.

The Foundation's expenditures on research have increased annually from \$250,000 in 1963-64 to \$617,000 in 1966-67, the latest year for which comparable data are available. Expenditures for 1967-68 and 1968-69 were of the order of \$600,000 and \$760,000 respectively. Approximately 60% of the research funds are allocated to extramural projects and 40% to intramural research.

The revenue of the Foundation, which is in excess of \$6,000,000 annually, is derived for the most part from the Provincial Department of Health.

Ontario Cancer Treatment and Research Foundation

The Ontario Cancer Treatment and Research Foundation was incorporated in 1943 by an Act of the Legislature of the Province of Ontario and reconstituted by *The Cancer Act, 1957*, RSO Chapter 45. *The Cancer Act* states that the object of the Foundation is to establish and conduct a programme of research, diagnosis and treatment in cancer, including the establishment, maintenance, and operation of research, diagnostic, and treatment centres in general hospitals and elsewhere; the providing of facilities for undergraduate and postgraduate study, the training of technical personnel; and the provision and awarding of research fellowships.

In order to provide detailed and careful study of applications for grants in aid of research, all such requests are sent to qualified referees. Subsequently, the projects are reviewed by panels of physicians and scientists. Five panels have been established, one each for biochemistry, medicine, pathology, radiology, and surgery. The recommendations of the Committee on Cancer Research are considered further by an Executive Committee before they are brought to the Board of the Foundation for final approval.

The total expenditure on research was \$1,332,741 in 1967-68, representing \$612,806 (46%) for specific research projects and \$719,935 (54%) for maintaining and operating research establishments. The largest of these establishments is the Ontario Cancer Institute, which receives additional substantial operating support from the National Cancer Institute, a voluntary agency, and the Medical Research Council.

Ontario Mental Health Foundation

The Ontario Mental Health Foundation was established in 1961 by a special Act of the Legislature of the Province of Ontario with the primary purpose of the development of research and graduate education in the mental health field in Ontario. The members of the Foundation are non-professional, but they have the assistance of an Advisory Medical Board which in turn seeks the advice of professional committees, the membership of which is not confined to members of the Advisory Medical Board. The composition of the Advisory Medical Board and its committees is representative of the Health Sciences with equal emphasis on the behavioural and the biological sciences.

The Foundation has been in active operation since September 1962. During this time it has supported research in many aspects of mental health. To date, all applicants whose research proposals have satisfied the careful scrutiny of the various committees of the Advisory Medical Board and of external appraisers have been approved. It is the belief of the Foundation that the expansion of the research programmes to include a greater number of worthwhile research projects is inseparably related to the training of more and better qualified workers in the general field of mental health. For this reason a limited programme for the training of scientists in the field of mental health research has been initiated.

To date, it has been the policy of the Foundation to encourage and support worthy research projects in all pertinent areas of applied and basic science in hospitals, universities, and other institutions. There is no intramural programme. Since 1963, the submissions received for operating grants and major equipment grants have totalled \$4,715,201, of which \$3,209,710 has been awarded. For 1968-69 the amount allocated to research was \$942,000.

The income of the Foundation is derived chiefly from the Provincial Grant.

Ontario Heart Foundation

In 1952, the Ontario Heart Foundation was incorporated as a non-profit organization with letters patent under *The Companies Act of Ontario*. The main objective of the Ontario Heart Foundation is to obtain and channel funds for Heart Research in

Ontario. In 1953-54 the Foundation supported seven research projects involving approximately \$50,000. In 1968-69 the research expenditure was approximately \$1,180,000.

Since its inception, the Foundation will have made available in Ontario over \$7,000,000 for the specific purpose of combating heart disease by planned research and educational programmes.

According to the report of the Board of Directors, the Ontario Heart Foundation is the foremost non-governmental source of cardiovascular research support in Canada. At least 85% of all funds received are channelled into research and programmes directly related to the medical profession. The Ontario Heart Foundation has been a major force in promoting a climate in which research has flourished.

Most of the income of the Foundation is derived from public campaigns. Other sources include bequests, donations, and a modest provincial grant (see Table I).

COMMENTARY

The Foundations referred to in this report, with the exception of the Ontario Heart Foundation, were established by Provincial Statute. At the time of their formation they were designed to satisfy a public need. A review of their progress, in the areas of both research and service, indicates that they have well served the purpose for which they were created. All four were founded independently from *ad hoc* considerations. Their formation reflected a health research need that public representations made apparent at the time. It is now clear that they have satisfied this need well. In conducting a dispassionate examination of the Provincial Role in Health Research, one might fairly ask if such specific needs still exist today and, further, are they likely to exist in the future. In addition, it is probable that there are other needs in health research of a similar kind yet to be identified. It would seem that such needs are certain to change as society changes.

In view of the success of these programmes in the identified areas of Health Research, the Committee is of the opinion that other such programmes could be initiated with equally beneficial results immediately. For this reason it is strongly believed that a machinery must be developed that can respond smoothly and efficiently to changing needs as they become apparent. This should

be developed within the context of Recommendation 5 of this report.

THAT the allocation of all funds for health research by the Province be made on the recommendation of a representative review committee which has had the opportunity of appraising such arrangements for funds in the light of provincial needs, such a representative committee to report to the Ontario Council of Health, and Council in turn to advise the Minister on this matter.

In order that the Provincial Role in Health Research might continue to remain flexible and responsive to changing needs, it is recommended that all provincial funds for the support of Health Research be centralized, identified as such, and considered each year by a responsible representative committee. It would then be possible to study the totality of Health Research programmes supported by the Province. In this way, consideration could be given to the advisability of phasing out such programmes as may have become time-worn, along with the advisability of making other funds available for more urgent research programmes as needs become apparent. For example, such a representative committee might consider it desirable to embark upon a comprehensive study of the efficacy of the delivery of health care, or a comprehensive study of the most effective use of manpower in Medicine and other Health Science disciplines. The attractiveness of such compelling research programmes has been referred to elsewhere in the report.

In view of the foregoing it is recommended:

16. THAT the Provincial Role in Health Research continue to remain flexible and responsive to changing needs.

17. THAT all funds for health research provided by the Provincial Department of Health or other provincial departments be identified as such in the annual estimates of the department concerned.

18. THAT foundations, such as the Alcoholism and Drug Addiction Research Foundation, the Ontario Cancer Treatment and Research Foundation, and the Ontario Mental Health Foundation, continue to be

eligible to receive provincial grants for the support of the research component of their operation and, further, that the budgetary requests from these foundations be submitted annually along with an estimate of the requirements for the ensuing five years.

19. THAT, in view of the success of the above programmes and the rapidly emerging needs in health research, a machinery be developed to respond quickly to new needs as they become apparent.

20. THAT the three Foundations referred to in Recommendation 18 above, be encouraged to use peer group assessment and external referees in making allocations of research funds for both extramural and intramural research programmes.

21. THAT the allocation of all funds for health research by the Province be made on the recommendation of a representative review committee which has had the opportunity of appraising such arrangements for funds in the light of provincial needs, such a representative committee to report to the Ontario Council of Health, and Council in turn to advise the Minister on this matter (Recommendation 5). (In this way allocations to the three Foundations referred to above would be considered at the same time and in the same context as other new research programmes such as the Provincial Research Grant Programme initiated in 1968).

SECTION VI

Developmental and Applied Research

... the field of health services illustrates, perhaps better than any other, the paradox of our age, which is, of course, the enormous gap between our scientific knowledge and skills on the one hand, and our organizational and financial arrangements to apply them to the needs of men, on the other.

*— Royal Commission on
Health Services, 1965
Vol. 1,1. 10*

Applied and developmental research may be defined as research specifically devoted to the application of existing knowledge to the solution of practical problems. Examples of such practical problems are: the development of prosthetic devices, developments of materials in dentistry, time and motion studies in terms of manpower utilization, studies of rehabilitation techniques, development of surgical procedures, including organ transplantation, development and assessment of new drugs, assessment of progressive patient care, and efficacy of the delivery of health care.

In examining health research and health care in various countries, including Canada, one observes an anomaly. The provincial agencies with the most to gain from the results of medical research are administratively out of touch with the total research effort. *It is fundamental that we strive to achieve as soon as possible a rapprochement between health research and health care.*

While the present expansion of facilities and increased financial

support have decreased some of the problems associated with fundamental research, the fields of developmental and applied research are by comparison still inadequately supported. It is obvious, however, if fundamental knowledge is to be transformed into practical skills, that developmental and applied research must be an important feature of an overall research programme.

It should be recognized that the stimulus for fundamental studies in the health field often arises from problems originating in applied research. Failure to study and record within a community the natural history of disease and the results of treatment precludes seeing many health research problems as clearly as one should. Failure to develop an effective integration between these two areas of health research leads not only to the lack of proper development of knowledge derived from fundamental investigations but also impedes the initiation of fundamental research in areas important for health care in the community.

At the present time there are few co-ordinated programmes at a national level to provide funds to develop an integrated programme of fundamental and applied research within the health sciences. Although the theoretical range of support by the Medical Research Council (MRC) is fairly broad, in practice, support is usually not given for work which is developmental or applied. Thus a project which contains both fundamental and applied research components may be funded only with difficulty under present MRC policies. The Department of National Health and Welfare has provided funds for developmental and applied research but there is no certainty that, in the future, it will carry a major responsibility in this area.

Various private foundations have different policies. The Heart Foundation has tended to provide money primarily for fundamental research, although it has assisted in the development of units for applied research. The Foundation has recognized, however, that it cannot continue to carry the relatively high cost of applied research because such a policy weakens its other programmes.

An example of an existing integrated programme of fundamental and applied research in this country is that of our voluntary and government cancer agencies, which is given in Appendix A of this Section. Further discussion of the role of voluntary agencies will be found in Section IV of this report.

Areas of neglect or insufficient development are numerous. Two

examples will perhaps suffice to illustrate the problems which exist in this province.

The Assessment of Disease in the Community and the Effectiveness of Treatment (Appendix B). We need to know the incidence, prevalence, and natural history of all disease processes in the community and we need to have adequate measures for assessing how effective treatment is. This is particularly true when new drugs are developed to be used for the management of disease processes. These studies can most effectively be done by collaboration among the Health Sciences Centres, the regional hospitals, and other groups providing health care in the community. By involving medical practitioners and departments of epidemiology and public health in such studies, a co-ordinated programme could be established which would, in addition, have important effects on research and education.

Support for Developmental and Applied Research in the Surgical Disciplines (Appendix C). The development of new surgical procedures, the training of surgeons and associate staff, and surgical research requires the establishment and maintenance of facilities which will allow the effective integration of education, research, and service. At present there is not an adequate funding mechanism for this.

These are just two examples among many.

QUALITY OF APPLIED AND DEVELOPMENTAL RESEARCH

The standards of applied research must be improved. Otherwise, decisions relating to therapeutic programmes, screening procedures, or methods of delivery of health care, will continue to be based on inadequate and often inaccurate information. Up to now, the standard of applied research in the health sciences has tended to be inferior to that of fundamental research. This has been due to a combination of factors: inadequate support for personnel, inadequate facilities, disinterest on the part of the academic community and government, the artificial conflict between applied and fundamental research, and the real difficulties inherent in successfully prosecuting applied research. For these reasons, it is necessary that special measures and inducements be developed for encouraging both the training of competent personnel, and the development of facilities, etc., in the area of applied research.

RECOMMENDATIONS

From the preceding discussion, it is clear that in Ontario there are serious deficiencies in support for the field of applied and developmental research which is the important link between health research and health care. This Committee, therefore, recommends:

22. THAT consideration be given to providing administrative arrangements and provincial resources in support of applied and developmental research associated with health care in this province.

23. THAT, in effecting this proposal, there be careful co-ordination with other agencies now supporting programmes in health research.

24. THAT, in order to improve the quality and extent of applied and developmental research, new training programmes and special funding mechanisms be applied to this area when required.

APPENDIX A

THE PART PLAYED BY OFFICIAL AND VOLUNTARY AGENCIES IN THE DEVELOPMENT OF HEALTH SERVICES

In reviewing the development of health services in this province, it becomes clear that support by voluntary and official agencies has become a great stimulus to progress and development in specific fields. On the other hand, progress and development have been delayed for certain other fields of health where no formal source of support has been available.

As examples of the former, we might mention cancer and heart disease. In the case of cancer, there has been excellent co-operation between voluntary and official agencies and this province at the present time can be proud of the high standard of care given in this particular field, for reasons which shall be listed below. In the field of heart disease, a voluntary agency has carried the major load in supporting new developments and in encouraging more active clinical research programmes.

Kidney disease and non-tuberculous chest disease are examples of diseases which have not received a comparable support and, as a result, research and development of health services in these fields have lagged in comparison with the previously mentioned diseases. In short, there has been no voluntary or government agency to which interested physicians can turn for the support of measures which will quickly bring to the ordinary citizen the technical advantages of newly-acquired knowledge.

The Province of Ontario can be proud of its overall cancer services programme and particularly its radiotherapy services, which are outstanding in the world picture. Voluntary and official agencies are largely responsible. The Canadian Cancer Society has raised funds for lay education, research and welfare. The Ontario Cancer Treatment and Research Foundation has utilized government funds to develop a diagnostic and treatment programme along with a clinical research programme.

The Cancer Society has active education and welfare programmes in almost every community in Ontario and has raised vast sums to support cancer research and to assist in capital construction of research centres and housing accommodation for patients close by the Foundation's treatment centres.

The accomplishments of the Ontario Cancer Treatment and Research Foundation can be listed under several headings:

Professional Education

There has been assistance for graduate clinical training, particularly in the field of radiotherapy. The programmes of continuing education at our medical schools have been assisted and there have been regular postgraduate programmes on the subject of cancer. There has also been an active programme for the training of cytologists and cyto-technicians.

Clinical Research

Up to the end of 1964, the Foundation had spent more than \$2,500,000 on projects in clinical research, and in the support of personnel conducting clinical research. There has been a rapid escalation of funds available for these purposes since that time.

Statistics

Excellent studies have been made of the incidence of cancer in Ontario and of the effectiveness of treatment, so that the disease, as a community problem, is well understood.

Medical Services

- a) The Foundation has developed an excellent group of regional clinics in association with the necessary medical and ancillary staff;
- b) In association with the Canadian Cancer Society, hostels have been built in association with the above regional clinics;
- c) There has been an excellent system of records, particularly for radiotherapy, developed in the province, with co-ordination of these records at government level;

- d) A cancer detection clinic has been supported in the city of Toronto, primarily as a research project to determine the usefulness of such a venture;
- e) A diagnostic biopsy service has been made available to all physicians and dentists of the province;
- f) Prosthetic and speech services have been supplied as a special function of the Foundation;
- g) Methods have been found for making available to needy patients the special medicines required for the chemotherapy of malignant disease.

Support of New Developments

Without government support generously supplied by the Ontario Cancer Treatment and Research Foundation, this province would not stand at its present high level of efficiency. Support was given over 15 years ago for the development of a unique Canadian development, the first Cobalt-60 units, which are now in common use in this province and throughout the world. Similarly, support has been given for the development of Caesium 137 units and for betatron units. The Foundation played a major role in the initiation of radioactive isotope services in the province. Initially, radioactive-iodine was used primarily for the study of non-malignant thyroid disease but the Foundation generously gave its support to isotope services which are now available in all larger hospitals. Likewise, money has been available for the development of special scanning apparatus to be found in all regional centres. The active investigation and development of new drugs has also led to practical results.

Recently, the creation of the Ontario Mental Health Foundation, along the same lines as the O.C.T.R.F., has given impetus to development in the field of mental disease.

In the field of cardiovascular disease, we would not have in the province at the present time the excellent centres for the investigation and treatment of difficult cardiovascular problems without the help which has been given by the Ontario Heart Foundation. The initial support, given for investigative work and for the necessary equipment, has led to established procedures which in turn have come to be recognized by the Ontario Hospital Services Commission as forming part of regular treatment services.

It seems only right that all aspects of clinical medicine should receive the same moral and financial support which has been given to the specific diseases mentioned. Otherwise, we will not have an orderly and balanced development of our medical services. In the future, a better system should be found for supporting broadly the whole spectrum of clinical disease. It can be recommended to government without hesitation that there is good precedent for the value of government support in the development of clinical medicine.

APPENDIX B

DEVELOPMENTAL AND APPLIED RESEARCH IN SURGERY

Most granting bodies are organized for the support of fundamental research in which the project can be outlined in detail, assessed in a large percentage of cases by scientists schooled in basic research, and supported or not depending on its scientific value and in relation to other applications. With this, we are in agreement for this type of research.

In certain fields, and this applies particularly to the surgical disciplines, there are many worthwhile projects that do not fall into the "pure scientific category." These are looked on as developmental or applied and either are not considered within the terms of reference of the granting body, or receive a low priority in relation to the other applications.

A particularly striking example of such a problem is afforded by the need for animal laboratory facilities. The developmental field of research in surgical and allied disciplines requires the organization and maintenance of an animal laboratory with operating room facilities. Such a development requires adequate funds for space, equipment, personnel, and supplies. In general, funds for bricks and mortar seem to be forthcoming in the hospital, either from governmental or private sources. However, adequate support in the other areas is much more difficult to obtain. Aid for equipment can be obtained to some degree, but usually only in relation to a specific project, and of necessity limited. The acquisition and maintenance of personnel to run the laboratory is a perennial struggle of obtaining funds for their support.

In the field of surgery, a clinician can see a problem that has to be corrected. Once he has worked out an idea that might solve his problem, he must take it to the laboratories and develop a technique that will fulfil his requirements. When the technique is developed satisfactorily, he must assess it on a series of experimental animals. These animals of necessity in many cases must be followed for a

considerable period of time so that not only the immediate but long-term results may be studied and evaluated.

As the fields of surgery become more sophisticated, it may be that some accessory equipment, such as a heart-lung apparatus, hyperbaric oxygen chamber, artificial kidney, etc., is necessary to carry out the procedure. This implies not only obtaining the equipment, but hiring, training, and maintaining a technical team that is fully competent to handle the intricacies of the apparatus under the supervision of the doctors concerned. In all cases, this team is developed in the experimental laboratory and, in many cases, the team continues to function in both the experimental and clinical aspects. Financial support in our present organization presents serious difficulties.

The maintenance of the experimental surgical laboratory—animals, operating room, instruments and personnel—is a most difficult one from a financial viewpoint. The overall costs greatly exceed those that can be obtained from granting bodies. In some cases, support is obtained from different agencies so that the salary of one of the technicians may be from two or three different sources and has to be reassessed each year. This poses a very difficult situation when trying to assure stability of the laboratory and tenure of office for experienced personnel.

A Medical Scientist may have an idea that appears to have great merit, but he must try it out experimentally to see if it has possibilities. With no background to support it, he has little chance of obtaining a grant. If an established laboratory had some funds for such work, he could get on with a feasibility study and, if it had merit, he could then apply to a granting body with some hope of being accepted. The other great advantages that are well known are that this will encourage him to carry out research projects and, secondly, although his original idea may not be feasible, by pursuing it, he may well come up with some related project that greatly outweighs his original idea. In such a way have many of the world's outstanding discoveries been developed.

APPENDIX C

THE ROLE OF CLINICAL PHARMACOLOGY AND EPIDEMIOLOGY IN THE HEALTH SCIENCES CENTRE

Two major problems in assessing the value of medical therapy, and in our understanding of disease, are related to work in epidemiology and in what might be termed clinical pharmacology. Research in these fields has been hampered by a number of factors which include university attitudes, facilities, staff, and financial resources. Two examples illustrate the importance of these areas in respect to our ability to develop a clear understanding of disease in the community and the efficacy of therapy.

Hormonal Birth Control

The introduction of hormone therapy for the management of birth control has provided a major step forward in terms of a practical method for birth control in a large population. However, like all forms of therapy, there are potential hazards, particularly when the administration is for a long period of time. One possible risk with this form of therapy has been thought by some to be an increased risk of thrombo-embolic disease. However, although there have now been a number of reports stating that women taking this form of birth control have developed thrombo-embolic disorders, we are uncertain whether this is due to the therapy.

When attempts were made to learn what the incidence of thrombo-embolic disorders is in females in the reproductive period of their life, it was found that our data are very incomplete. In other words, we know very little about the incidence of thrombo-embolic disease in the community and in particular about this problem in women before the menopause. Furthermore, there has not been a systematic study of the differences between women taking medication and those who are not. If we had a method for studying these problems and collecting the necessary information, our approach to this problem could be much more efficient. This involves both the fields of epidemiology and clinical pharmacology.

Assessment of Drug Therapy in Chronic Diseases

Dicumarol, for the management of arterial thrombosis, illustrates one of the major problems facing medicine today: how to evaluate properly the value of expensive, long-term forms of therapy. This can only be done by properly designed and executed clinical trials in the community. To do this, the resources of the university Health Sciences Centre and the medical community are required. This again involves both clinical pharmacology and epidemiology.

There is little sense in spending large sums of money for “fundamental” research and then fail in our application of this knowledge to the management of problems in the health field.

Problems in Developing These Areas

a) University

Recognition must be given to the development of epidemiology units which are broadly based and which study diseases as a whole in the community. This could well be an important component of the family practice unit in the Health Sciences Centre. There must be developed groups with an interest in the assessment of the efficacy of therapy in the community. This could be under a group in clinical pharmacology.

b) Records

An efficient centralized record system will be required. These should be interchangeable between the various centres.

c) Education

Proper development of both of these fields with their integration into the medical curriculum could provide valuable teaching material and teach the embryo doctors the value and need for a critical assessment. This might, if it is well done, stimulate some of the students to take up careers in these fields. This is important since we are short of well-trained, first-class staff.

d) Resources

At present there is no simple method of financing these activities. Since this area involves the fields of education, research, and public

health, it is apparent that our present system of granting money does not allow for an overall grant to cover this type of operation. The M.R.C. and the Department of National Health and Welfare do not provide adequate coverage. It would seem important for the Provincial Government to recognize the importance of this area in respect to the Health Sciences Centre and for public health in the province. Appropriate measures should be undertaken for a rational and realistic support programme.

SECTION VII

The Interdisciplinary Nature of Health Research

The study of problems in health research involves many disciplines, such as medicine, comparative medicine, biology, biophysics, biochemistry, dentistry, nursing, and pharmacy, as well as groups in the community. A health research project may require only one person working in a relatively restricted area, or it may involve the expertise of individuals from a number of disciplines. This latter multidisciplinary approach is becoming increasingly important and, in fact, the contribution from certain disciplines in respect to research may be largely within this context.

The multidisciplinary approach is in keeping with the view expressed earlier in this report that health research must be considered as a continuum and that such research cannot be categorized under limited terms such as “fundamental” or “applied” research. These two aspects of scientific development, i.e., the continuum between basic and applied research, and the benefits of multidisciplinary research, are clearly evident in the recent study by the Illinois Institute of Technology (TRACES) of the history of development of five important technological advances to health. In respect to two areas of interest to biology, the development of the electron microscope and oral contraception, the report clearly demonstrates the constant evolution of the problems from basic science in many disciplines, to the eventual application to society. The close interrelationship between so-called basic research and application has also been vividly described by Townes in relation to the development of the laser. Townes emphasizes the wide applications of the laser in many fields, including medicine, and how direct

“applied research” to achieve these ends would have been inefficient, at best.*

In considering any programme in health research, it is therefore necessary to decide whether this is best developed within an individual discipline or as a continuum. It is extremely important, in this context, to recognize that the same standards of excellence have to apply to all areas of research, from molecular biology to community health care.

There are a number of factors which have to be taken into account in assessing the need and usefulness of multidisciplinary research:

- 1) The effect of the knowledge which has been developed within the natural sciences as related to problems in health.
- 2) The availability and competence of the manpower available to participate in educational programmes in health research.
- 3) The resources available for establishment of graduate school programmes.
- 4) Whether a discipline is sufficiently broad to encompass all the needs of a graduate programme in health research.

It is apparent that, for an individual to work effectively in programmes related to cell biology today, he not only needs experience in areas such as biochemistry but he must also understand aspects of biophysics, genetics, and cell biology. He can best achieve this in an integrated graduate school programme rather than in a fragmented programme. Similarly, for a nurse to take part in health research, she not only needs to be exposed to the nursing aspects of the problem but in addition needs to understand the nature of health research and the areas which are related to the fields which she wishes to explore.

It is difficult for a nurse to assess adequately the efficiency of

* “Quantum Electronics, and Surprise in Development of Technology, the Problem of Research Planning,” Charles H. Townes, *Science* Vol. 159 (No. 3816): pp. 699-703, 1968; and *Technology in Retrospect and Critical Events in Science (TRACES)*, prepared for the National Science Foundation by the Illinois Institute of Technology, Research Institute, under contract NSF-C535, Vol. 1, Dec. 15, 1968.

nursing care in a particular situation without having had experience in related subjects. In order to be a productive member of a research group, she might require training in psychology or other aspects of the behavioural sciences, biomathematics and pathology or cell biology. The same holds true for individuals trained in medicine, dentistry, or pharmacy. To establish graduate programmes in each professional discipline, capable of providing an adequate education, would require an enormous duplication in staff and resources. It does not seem reasonable, in view of the limited resources, to recommend the development of extensive health research programmes in a number of disciplines in an unco-ordinated manner.

In view of the above considerations, *the most feasible solution in terms of the needs of individuals for training in health research is to establish multidisciplinary graduate school programmes in health research.* This recommendation is in keeping with the broad concept of the Spinks Report* and the remarks of President Corry.** These programmes could be the responsibility of the health sciences divisions within the universities. An individual wishing to be trained in health research would then enter into that aspect of this programme most suited for his particular needs. In this way the subject matter of relevant areas (e.g., biomathematics, psychology, biophysics, pathology, paediatrics, or medical sociology) necessary for the experience of the individual would be available. In addition, the interdisciplinary approach will help to establish higher standards in all areas, since the group with the highest standard will tend to raise that of the others. In this way, a uniformly high standard of personnel trained for health research might be attained in all disciplines. When appropriate, graduate programmes should not only involve groups within the university but also groups within the community.

These considerations can serve as guidelines for the development of research in the professional disciplines as described in the rest of this report. In addition, they are of considerable importance in respect to the philosophy of the development of graduate school programmes within the universities and within health sciences

* Report of the Commission to Study the Development of Graduate Programmes in Ontario Universities, submitted to the Committee on University Affairs and the Committee of Presidents of Provincially Assisted Universities, November 1966.

** Address to meeting of representatives of Ontario Universities on May 12, 1968, by James A. Corry, the then Chairman of the Committee of Presidents of Provincially Assisted Universities of Ontario.

centres. They also are of importance in the establishment of adequate training programmes particularly in those areas where there is a demonstrated lack of competent personnel.

If effective health research programmes, in respect to health in the community and health care, are to be developed, it is essential that multidisciplinary programmes of this nature be established as soon as possible. These programmes should include not only universities, but groups in the community as well.

The Health Research Committee of the Ontario Council of Health should be sufficiently representative to be capable of considering the whole rather than the part in health research. It should be capable of advising government of areas in which multidisciplinary research would be especially effective. In addition, it should encourage, where appropriate, co-operation between universities and community groups in these programmes.

In view of the interdisciplinary nature of health research and its importance to health care programmes, it is recommended:

25. THAT, since resources are limited and it is important to maintain high standards in all areas of health research activity, encouragement be given to the development of comprehensive graduate school programmes in the health sciences.

26. THAT, to achieve the objectives of Recommendation 25, a mechanism be developed to encourage and support interdisciplinary research and graduate study programmes among all the health disciplines.

27. THAT encouragement be given for multidisciplinary research programmes and graduate programmes involving university and community groups.

SECTION VIII

The Training of Research Personnel

In a health sciences centre, the quality of the scientific work, education programme, health services, and the staff, are all closely interrelated. In terms of its undergraduate and graduate programmes, the strength of a health sciences centre today is largely dependent upon facilities, and on the calibre of its teacher scientists. The staff of the health sciences centres should be capable of providing a stimulating and up-to-date curriculum and to be in the position to innovate in respect to new methods of teaching, treatment, assessment of disease in the community, and the appraisal and development of new methods of delivering health care. To achieve this, there is a need for a corps of individuals with first-class scientific training in all areas, ranging from disciplines such as biochemistry through to epidemiology and nursing.

One of the severe shortages in terms of new staff is in individuals educated in health research. Clinical departments of dentistry, medicine, and nursing are largely staffed with personnel experienced in the art of health care but ill-trained in science. Until recently, there was only one school in Canada, and none in Ontario, offering graduate scientific training for individuals in clinical disciplines. In addition, many of the pre-clinical departments in health sciences centres are inadequately staffed with competent teacher scientists. When one considers the research needs in the areas of applied and developmental research, nursing, dentistry, pharmacy, and other areas, this shortage is even more acute than in the medical schools themselves. *If adequate programmes are not established in these areas, to develop the kind of personnel who can conduct competent*

health research programmes, then the development of health care delivery systems and efficient methods of prevention and treatment will be seriously impaired in this province.

At present, there are several factors which impede the training of teacher scientists in respect to delivery of health care. These are:

- 1) The training regulations of professional organizations such as the Royal College of Physicians and Surgeons of Canada;
- 2) The attitude of graduate schools in the universities towards the development of integrated science programmes in clinical departments;
- 3) The funding mechanisms for the training of personnel;
- 4) The restrictive attitude of university medical schools, schools of nursing, schools of dentistry, schools of pharmacy, and other schools, in respect to the employment of individuals capable of conducting adequate programmes in health science.

The training regulations for the Royal College of Physicians and Surgeons make it very difficult for a man to pursue a scientific career in a clinical department. In most of the fellowship training programmes, the postgraduate student spends a one or two year period of training in research, either in his department or one of the basic science units. This period of training is usually wasted in terms of clinical experience and is inadequate under present arrangements in terms of scientific training. The resident comes from this programme ill-prepared to understand, or to cope with, the advanced techniques used to study health problems and has only a faint glimmer of the scientific discipline which is essential if one is to pursue a research career in health. He often has detailed knowledge in a restricted area, which limits his usefulness in the management of many clinical problems. It should be pointed out that the postgraduate programmes required for training in research are distinct from programmes of postgraduate training associated with preparation for examinations by professional bodies. In this respect, while important for the training of people in clinical specialties, the funds expended in these latter directions should not be considered as a resource related to the training of teacher scientists.

To train individuals for a research career, it is necessary to put them through the rigors of a scientific training programme, which for

the average individual usually involves at least three years under the supervision of a competent scientist. The Royal College of Physicians and Surgeons is primarily oriented to licensing of physicians who practise specialty clinical medicine. It would appear, therefore, that the training of scientists at the clinical level may have to involve either modification of the Royal College of Physicians and Surgeons practice in respect to its training regulations or the development of some other training to complete the full Royal College programme. If the two programmes (Royal College and research training) are essential for training in clinical science, then this adds up to a total of at least eight years of postgraduate education. This seems to be an excessive length of time, since it means that a student would have to spend fourteen years in training from the time he entered university. This is surely a very uneconomical and wasteful method for preparing such individuals. It can hardly be justified on any logical grounds and cannot be justified on economic grounds. These same arguments hold true for other professional organizations, such as the Royal College of Dental Surgeons.

Until recently, many graduate schools in Ontario universities regarded scientific training programmes in clinical health research as being inappropriate for the university. Since most of the clinical departments were staffed by individuals who had not been trained scientifically, there was some justification for this attitude. However, this attitude of the graduate schools does not help the development of useful programmes in clinical or community health research. Recently, a change has occurred and there is evidence that several institutions may now be able to initiate Ph.D. programmes dealing with humans in a clinical or community setting.

The provision of adequate funds for training in the scientific aspects of clinical or health research has until recently been a major problem. The voluntary health agencies have initiated programmes in some of these areas. They have helped to establish a nucleus of manpower which is now available to allow for further developments.

Careful consideration should be given to expansion of this programme of support, since if adequate training programmes are not available then it will not be possible to attract young men and women into this type of career. These remarks are particularly appropriate for the fields of dentistry, nursing, pharmacy, and epidemiology, where the shortage of manpower is very acute.

If adequate financial resources for training can be made available

and if the professional and academic restrictions can be removed, then the conditions should be such that adequate programmes of training can be established. However, in addition to providing good training, it is essential that schools such as medicine, nursing, dentistry, and pharmacy, recognize the need to appoint members with a scientific training to their staff and not to insist upon the more classical patterns of training before they will appoint such individuals. It should be pointed out that there are a number of encouraging trends in this direction in some Ontario universities. In addition, the organization of these schools should be such that these people can function adequately as scientists dealing with the problems in their fields of interest. It is recognized that departments also have a primary responsibility to provide excellent service or patient care in their respective areas of responsibility, but this should not preclude the scientific assessment which is so essential to the development of effective health care. In addition, there is a need for the preclinical scientist to recognize the value of training individuals with a broad outlook who are working in the fundamental areas of human biology (see Section on Interdisciplinary Research). It is tempting to set up a preclinical department composed largely of people with a parochial interest. Such individuals tend to be very narrow in their outlook and often provide inadequate programmes for the student in the health sciences. A serious attempt should be made to recruit individuals with a broad outlook for the preclinical departments, including some personnel with medical training.

Serious thought should be given to an attempt to combine the undergraduate training in health sciences with an advanced scientific education. Some schools have either proposed or initiated a joint professional-Ph.D. programme. This could be a worthwhile solution to the problem of training health teacher-scientists. Such a programme could reduce the number of years of training and therefore provide a high quality staff without unnecessary delay and excess cost. It could also help to recruit able students into careers in health research. It should be pointed out that, providing standards are maintained, it should not necessarily be essential for individuals with higher professional training to obtain a Ph.D. in order to pursue a useful career in health research.

To establish a joint professional Ph.D. programme, it may be necessary to provide special funding for selected students who thus could enter the programme early in their health science training.

Because of the rapidly changing patterns of health research and

of the basic knowledge related to health research, there is need for provision which would allow individuals to take further training in relation to specific programmes.

In some of the schools there are staff members who have not had training in research who, because of their other attributes and abilities, would benefit from being able to take a period of research training. Such individuals, given the opportunity to be freed of their present responsibilities to take such training, are a potential nucleus of talent in fields where there is a shortage of such talent.

In view of the importance of scientifically trained personnel in the health care programme and the present shortage of such personnel it is recommended:

28. THAT support be provided to encourage the training of suitable individuals in health research; the programmes be such as to identify students with talent and facilitate and encourage their development; and the training programmes be of a uniformly high standard.

29. THAT university graduate schools be sufficiently broad and flexible so that effective graduate programmes on an interdisciplinary basis in health sciences be encouraged. (See Section VII.)

30. THAT the training requirements of professional organizations and universities be such as to encourage rather than discourage the scientific training of personnel in the clinical areas.

31. THAT special funding be provided to help initiate and develop combined professional and Ph.D. programmes.

32. THAT special programmes be established to enable existing members of staff to undergo any special retraining, related to research activities, which is considered necessary by both the individual and the health sciences centre.

SECTION IX

Health Research in Dentistry, Pharmacy and Nursing

In this chapter brief statements on the status of research in dentistry, pharmacy, and nursing are presented. These sections were drawn up in consultation with members of these groups and demonstrate real needs in these areas in respect to the education and research functions of these disciplines. In considering health research in these areas, the Committee has taken into consideration the recommendations in Sections VII and VIII of this report.

Careful study, particularly of the submissions concerning research in dentistry, pharmacy, and nursing, has further emphasized that health research should be oriented in terms of the programme or objective, rather than only the interests of the professional personnel involved. This means that most, if not all, health research should be a team effort to which contributions are made by people trained in medicine, biology, biochemistry, dentistry, nursing, pharmacy, nutrition, public health, administration or other areas. Among other skills which may be necessary for the development of some of the broad health research programmes are sociology, psychology or social anthropology. It is therefore not acceptable from both an economic view and for the most efficient health research and health care, that each of the professional groups in the health sciences should attempt to “go it alone” in health research projects, particularly when they can be given substantial help from other disciplines which could determine the success or failure of a particular project.

This means that no subdivision of the health sciences, whether it be a school of medicine, nursing, dentistry, pharmacy or any other

school, should proceed in graduate training as if all the other disciplines did not exist. The reason why this should not happen is because no single discipline or school has all the knowledge and skills required for optimum development of health research projects. It should be pointed out, however, that within disciplines, there may be personnel suitable for more circumscribed health research programmes.

It is clear that there is a need for dentists, pharmacists, nurses who are adequately trained in research methods. To this end, resources should be made available for the development of adequate training programmes as well as health research programmes involving individuals from these disciplines. The Committee recognizes that more than in medicine, these disciplines have an acute shortage of personnel trained in health research.

A. RESEARCH IN DENTISTRY IN ONTARIO

1. Introduction

Dental diseases affect more people than any other malady. They begin early in life and continue until death or loss of all teeth ends the problem.

Some idea of the state of dental health of young Canadian adults can be obtained from a recent survey* of entering army recruits, 99 per cent of them between the ages of 17 and 24. In the survey, a random sample of 400 recruits enlisting in each of 6 centres across Canada were chosen. The average Army entrant had 14.6 decayed, missing or filled teeth. Of this total number of teeth, only 20.1 per cent were filled while 30.7 per cent were missing and 49.2 per cent were decayed.

Each of the recruits received complete dental care and time and cost studies were made. Results of the study showed that each recruit needed 7.9 hours of dental care at a cost of \$196.00 per man.

While dental decay is most destructive in the younger age groups, periodontal disease takes its toll of teeth at a later date. The greatest proportion of teeth are lost through diseases of the supporting structures after the age of 35.

* Royal Canadian Dental Corps Health Survey, 1968 (unpublished)

Probably the foregoing brief description is sufficient to illustrate that dental diseases cannot be combatted successfully by treatment measures alone. A major effort of basic and applied research is necessary to discover and implement preventive measures which will bring the diseases under manageable control.

2. The Needs in Dental Research

Before 1950, funds for dental research were practically non-existent. In the mid-1950's the dentists of Ontario established a fund of \$150,000 for use in the Faculty of Dentistry at the University of Toronto. National Research Council and Federal-Provincial Health Grants became available in amounts that could begin to support the few trained dental investigators.

In Ontario, \$128,000 was spent on dental research in 1968. A crude estimate of the expenditure of funds for dental care by Ontario residents in the same year can be obtained by multiplying the average gross annual income of dentists (\$31,000) by the number of dentists (2,850) for a total of 88.3 million dollars.

It seems reasonable that something greater than 0.14 per cent (\$128,000/\$88.3 million) of the costs of correcting dental defects should be expended on finding methods to prevent dental disease.

Some of the factors which influence dental research are listed below. They are not necessarily listed in order of importance but they are interrelated.

1. Until now, dental and medical education in Ontario has been conducted in separate schools of the university, with some co-operation in the basic sciences but very little in the clinical fields.
2. The basic sciences have been taught mainly by medical basic science staff who are not acquainted with problems related to the oral tissues.
3. The relatively low emphasis of dental schools on research seriously affects the quality of teaching and the effort to encourage dental undergraduates to pursue careers in health research. One cause for this is the low percentage of full-time staff in the dental schools. For example, only 12.0 per cent of the staff in the University of Toronto Dental School were

employed full time in 1967/68 compared with 26.0 per cent in the rest of Canada*. In addition, only limited funds are available for the education of postgraduate students in this area. The combination of these factors, and others, has resulted in dental schools, particularly in Ontario, having poor student: staff ratios. For example, in 1967/68 student: staff ratios were:

In Ontario Dental Schools	10.5:1**
Five other Canadian Dental Schools	5.5:1
Ontario Medical Schools	4.4:1

- 4. Dental diseases have not assumed a high rank on the public's or the government's scale of health research priorities.
- 5. In spite of the fact that the Royal Commission on Health Services recognized the poor state of dental health of Canadians by devoting one quarter of its recommendations to dental health, few of the recommendations have been implemented. When governments pass health legislation they usually exclude dental health. Since major governmental funds are not committed to dental care, the development of dental research, care facilities, and dental schools, is inhibited.
- 6. There has been little development by interested citizens to establish funds and foundations to support dental research.
- 7. Very few hospitals have adequately balanced dental departments, thus limiting opportunities for dental research and the mixing of dental and medical postgraduate students which would lead to co-operation in the study of health problems of mutual interest.

3. The Nature of Dental Research

Dental research requires the same interdisciplinary approach as for other health sciences. Indeed, most of the fundamentals of human biology are essential for the establishment of good dental research programmes. Thus, to establish an independent research programme, a school of dentistry would require, among others, biochemists, microbiologists, biophysicists, epidemiologists, social scientists, cell biologists, pathologists, individuals with an interest in natural science. Much of the manpower for these disciplines can be provided from the existing staff in the universities. However, in order to

* McDonald Report to the Users Committee, Faculty of Dentistry, University of Toronto, 1969.
** Users Committee Report, Faculty of Dentistry, University of Toronto 1969.

achieve this objective, it is important for the disciplines to recruit staff who are prepared to take into consideration the needs of dentistry.

It is envisaged that future research in dentistry will involve an expansion of the clinical sciences in terms of health care delivery and prevention of disease.

University Teaching Hospitals should be encouraged to increase their facilities for dentistry so that more meaningful clinical scientific studies can be launched in association with other disciplines.

B. RESEARCH IN PHARMACY IN ONTARIO

1. Introduction

Pharmaceutical research is concerned with drugs—e.g., their isolation from natural sources, synthesis, physiological action, toxicity, formulation of dosage forms, analysis, stability, and metabolism. In addition, it includes the investigation of problems related to the practice of pharmacy, such as those of an economic or sociological nature. Laboratory research is conducted in the university, in the pharmaceutical industry, and in hospitals. Investigations concerned with practice may be conducted by professional groups as well as in hospital pharmacies and the university.

The “pharmaceutical sciences” (pharmaceutics, pharmaceutical chemistry, pharmacognosy, pharmacology) are interdisciplinary in nature, having components of both the biological and the physical sciences. Thus, pharmaceutical scientists may draw together and utilize in a given study the relevant components of, for example, physical chemistry, biochemistry, plant physiology, physics, microbiology, and organic chemistry.

2. Needs of Pharmaceutical Research

Current extramural support for pharmacy in Ontario for 1968-1969 is \$210,055.

Because of the interdisciplinary nature of pharmaceutical research, it is difficult for a single School of Pharmacy to establish a graduate programme with the necessary competence in all areas.

Among the limiting factors are manpower and resources. It is also clear that much of pharmaceutical research should be part of a multidisciplinary research programme rather than a more narrow programme within the discipline. The various groups (i.e., pharmacology, pharmacy, clinical pharmacology and others) could create a joint graduate school programme for research and training activities. This should be part of the health sciences research and graduate education programme and subject to the same standards as the other programmes.

With the assumption by the Medical Research Council of responsibility for the funding of research in the schools of pharmacy on the same basis as in the medical schools, research in the pharmaceutical sciences in the School of Pharmacy, University of Toronto, is now better supported than previously. Nevertheless, there are important areas not included. Moreover, with the development of broader professional responsibilities for hospital pharmacy and the expansion of residencies in that specialty, an increasing amount of research is being done in these institutions. Most of these projects are not eligible for support by existing agencies.

A teaching staff actively engaged in research is essential to maintain a strong, undergraduate programme in any discipline. Especially is this true in health science fields, such as Pharmacy, where constant new developments need to be reflected promptly in appropriate curricular and course changes. The dynamics of a research-oriented school thus provide a constant stimulus to both staff and students.

Research is, of course, vital to the graduate programme. It is an essential part of most master's and doctoral programmes which in turn are required for the training of future university staff and industrial and government researchers in the pharmaceutical sciences. The advancement of knowledge flowing from such research serves to attract good students with all that this means in terms of future quality of research in universities, industry and government laboratories. A viable graduate programme cannot exist without research. Good individuals cannot be attracted or retained unless adequate research facilities are available and unless an active research programme exists.

3. Nature of Pharmaceutical Research

An excellent example of the interdisciplinary nature of

pharmaceutical research is seen in the development of new drugs where the following disciplines are involved:

Chemistry – synthesis or isolation of a new compound.

Animal Pharmacology – demonstration of pharmacological activity.

Pathology – demonstration of the presence or absence of toxicity to tissues with demonstration of possible “target organs.”

Clinical Pharmacology and Human Pathology – establishment of dose levels, metabolism and effectiveness. Testing of drugs in humans under rigidly controlled conditions.

Pharmacy – development of suitable dosage forms and establishment of stability and quality control.

Biochemistry – animal and human metabolism and mode of action.

Clinical Medicine – long range observation of primary drug effect, side effects and possible drug reactions.

It is apparent, therefore, that certain aspects of research on drugs may receive attention in some or all of many relevant university departments. *Thus, it is essential to have co-ordination of research on drugs within the traditional departments in the university, within the community and between these groups and government and industry.* Such co-ordination is required in order best to promote and develop the available skills, to prevent unnecessary duplication of effort, and ultimately to provide more efficacious, safe and economical drugs.

Pharmaceutical research yields substantial dividends in improved health care. Clinical, economic and sociological factors are all involved. Following are some examples of actual and/or potential benefits: safer, more efficacious, less expensive medication, improved analytical methods for drugs; more stable and/or more consistently effective dosage forms of specific drugs; sociological implications of studies on drug usage and distribution problems; aid in solving problems of drug abuse; improved patient care in hospitals resulting from studies of patients’ drug profiles, including follow-up of out-patient drug usage—valuable contributions to knowledge of drug reactions and drug-drug interactions; improved care and service, including public health information, provided by more knowledgeable practitioners.

Some useful studies are currently being performed in conjunction with the hospital pharmacy residencies. To the extent that the Ontario Hospital Services Commission supports this programme, the personnel are available to direct and conduct these projects. To carry some of these investigations further to practical conclusions within a reasonable time requires other financial support. Some of these projects are related to drug therapy, others to drug control and evaluation, some to patient care procedures, and some to other hospital pharmacy administrative problems.

There is probably considerable scope for the development of hospital-based research in Pharmacy especially in the area of Clinical Pharmacy and Pharmacology.

C. RESEARCH IN NURSING IN ONTARIO

1. Introduction

Formal research in nursing began in 1929 with the Weir Survey of Nursing Education in Canada sponsored by the Joint Study Committee of the Canadian Nurses' Association and the Canadian Medical Association. As in most professions, there were few studies done until the end of World War II when Canadian nurses recognized the need for planned reorganization of nursing education and nursing services.

Demonstrations and evaluations of new patterns of nursing education began in the late 1940's. In the 1950's a survey of nursing education focused on the readiness of nursing schools for accreditation. More recent studies resulted in new designs for achieving quality in nursing education. In the 1950's attention was directed toward nursing service through time and activity studies in hospitals and health agencies. During the 1960's the needs of patients and families were studied. Current studies are exploring new roles for the nurse in the hospital and in the community in relation to health care programmes.

2. The Needs in Nursing Research

Quality nursing practice is based on sound nursing theory which must be identified and tested through nursing research.

Immediate needs for research in nursing seem to fall into the following areas:

- a) Patient-care projects to determine how nursing measures can contribute to therapy, rehabilitation and the promotion of health.
- b) Research regarding relationships among nurses, doctors, and other members of the health team, to determine the best use of skills in different situations involving the prevention of disease and care of the patient. This would include research by the nurse in community health care and patient care.
- c) Nursing education and administration.
- d) Participation of suitably trained nurses in general programmes in health research.

Of the eleven Ontario nurses with doctorates, only four are engaged in research activities. Opportunities for the preparation of teacher-scientists in this area are limited in both Ontario and Canada. The first master's programme in nursing in this province began in 1960. Less than one per cent of the practising nurses in Ontario have master's degrees. The depth of professional preparation for research in nursing varies from institution to institution. Limitations of faculty, in respect to numbers and competency, constitute crucial restricting factors.

Some of the circumstances and factors which have militated against the development of nursing research are herewith noted. They are not necessarily listed in order of importance but they are interrelated.

- 1) A lack of interest by the nursing profession itself, by the members of the health disciplines and by the general public.
- 2) A lack of definition of the subject areas suitable for research by nurses.
- 3) Very few nurses have received education and training in research methods. Very limited funds have been available for graduate education in nursing.
- 4) It has been difficult for schools of nursing to provide an

environment in which nurses, trained in research, can work satisfactorily. For example, the heavy demands for participation in other activities placed on the few who have the qualifications to do research have precluded their engagement in this activity.

- 5) Few opportunities for the employment of qualified nurses interested in pursuing careers in health research have existed within universities, hospitals and other community health agencies.
- 6) Traditional approaches have inhibited a spirit of creativity and innovation in nursing practice and research.
- 7) Funds for nursing research are inadequate. M.R.C. research development funds are not presently available to Deans of Nursing as they are to Deans of Medicine and Dentistry.

University Schools of Nursing should participate in an integrated graduate programme. In order to become proficient in research methods and techniques and to implement programmes of basic and applied research, they need encouragement and financial assistance. *Such schools cannot function as separate entities but must be part of a health sciences group.*

Immediate and long-term planning and action are needed to:

- a) Introduce basic and continuing education programmes for selected nurses interested in acquiring research skills in the health sciences.
- b) Provide nurses in master's programmes with theory and practice in research methods and techniques.

3. The Nature of Nursing Research

Graduates of medicine, dentistry, pharmacy, and others are not taught how to do research while they are in their training years. It is, therefore, not possible that nurses, who complete a rather generalized baccalaureate, can have much research content in their undergraduate programme.

Whether training in nursing per se constitutes an adequate base for further research-oriented master's and doctoral studies is open to considerable question.

Nursing training, however, does have a base for what may be called a postgraduate professional training programme, as is the case in medicine. This means more course work or experience in a particular field such as administration, teaching, obstetrics, surgical nursing, microbiology, medical and psychiatric nursing, communicable diseases, nursing in various types of intensive care units and, no doubt, many others. These programmes, as is the case for the Royal College programme in medicine, are not preparation for research. They are job-oriented and very useful and important in this regard.

The nurse who wishes to do research work may have to specialize in a subject of separate academic identity such as sociology, psychology, social anthropology, various aspects of educational theory, or the biological sciences. She should then go through the same steps as do people in these disciplines in acquiring research skills.

This type of broad programme can not be done exclusively in Schools of Nursing. In order to strengthen the Schools of Nursing for graduate programmes in health care, the requirements for graduate work should be administered by a Health Sciences Graduate Division. This will mean that all the research personnel of the total Health Sciences Division will be able to help and to supervise research training in Nursing as for other professional groups in the Health Sciences Division.

The need for nurses who are adequately trained in research methods is clear. To this end more money should be made available for M.Sc. and Ph.D. programmes which are providing training in health research. It appears to be necessary that the Health Sciences Centres in Ontario take a more active interest in graduate research training for nurses.

RECOMMENDATIONS

In view of the foregoing considerations it is recommended:

33. THAT research in dentistry, pharmacy, and nursing, be part of an interdisciplinary research programme in the health sciences.

34. *THAT, in keeping with the recommendations in Section VII of this report, graduate research programmes in dentistry, pharmacy, and nursing, be oriented in terms of the research objectives, rather than a sectional interest of the professional personnel involved.*

35. *THAT, when necessary, special fellowship programmes be established to encourage the training of individuals in health research in the disciplines of dentistry, pharmacy, and nursing.*

36. *THAT special programmes be instituted for retraining purposes. The special programmes related to retraining, as outlined in Section VIII and Recommendation 32, are particularly applicable to dentistry, pharmacy, and nursing.*

37. *THAT, because of the importance of prevention in dental care and the need for research in this area, substantial funds be made available for the development of health research in dentistry.*

38. *THAT, when appropriate, teaching hospitals and group medical programmes at health sciences centres develop comprehensive dental departments to provide dental clinical research opportunities.*

39. *THAT, in respect to nursing, centres be developed in Ontario for the training of nurses in research, as distinct from professional, job-oriented master's programmes.*

SECTION X

Research by Disciplines Allied to the Health Sciences

GENERAL

Several groups contribute directly and indirectly to new knowledge in health research. Among these groups are biologists, biochemists, veterinary and agricultural scientists, food scientists, and social scientists. Expansion of our knowledge of the biological systems, for example, has depended a great deal on the research of cytologists among the above named groups, working on the molecular level, and particularly in studying 'abnormal' life processes. It is obvious that progress in the identification of cellular aberration must be preceded by a better understanding of normal biological processes at the molecular level. This is only one example to indicate that health research will be enhanced through support of all scientists capable of making a contribution to biomedicine. Health research and biological research in its broadest sense are intimately related and a great deal of health related biology is conducted in a non-medical environment.

It is significant to point out that biology oriented groups are an important source of faculty personnel in departments of health sciences centres and they provide education for students and for personnel auxiliary to the health sciences.

Researchers in several disciplines, e.g., sociology, geography, architecture, urban planning and engineering, are making contributions to human health. It is becoming clear that, while their interests are peripheral, these workers will be called upon to co-operate increasingly, as the team approach to research gains wider acceptance.

The concept of team research began by the recognition of the need for several approaches for the solution of biological problems. This resulted in the penetration of departmental boundaries in the development of co-operative programmes. Arising from this has been the bringing together of different disciplines, on the assumption that problems can be attacked on a much broader base through an administrative organization including several scientists with different special interests, into a single group. For example, this concept is behind the proposal to establish an Institute of Biomedical Research at Guelph, which would provide a central animal facility for the development of the full scope of animals in health research in Ontario, whereby the health sciences centres and scientists in the appropriate disciplines in the university community in Ontario would engage in co-operative research. This plan envisages the mounting of certain programmes through wide-based collaboration, which might be impossible to achieve without the unique resources that can be brought to bear by such collaboration.

STUDIES WITH LOWER ORGANISMS ESSENTIAL TO HEALTH RESEARCH

Virtually all the major medical advances have resulted from studies on animals. For example, developments in the production of vaccine, antibiotic, anticarcinogenic agents and anticoagulants, endocrine and diuretic therapy, as well as in transplantation and immunochemical studies, are but a few of the fundamental areas that have their foundation in basic biological studies. Biological and other non-health science departments in universities contribute to both experimental techniques and essential knowledge.

There are a great many biomedical models in animals with similar metabolic disease counterparts in man. There are also anatomical and physiological similarities as well as a common immunity or susceptibility to some diseases which make certain species highly suitable as experimental models. For example, piglets have been advocated as the prototype for infants in pediatric research because of similarities in the respiratory, renal, digestive, and haematological systems of these two species.

EXAMPLES OF CURRENT RESEARCH PROJECTS AT THE INTERFACE OF HEALTH, BIOLOGY, SOCIAL SCIENCE, AND AGRICULTURE

Projects at the interface are too numerous to list, but a few examples

of different areas of research will serve to show the importance to health research of work contributed by scientists in allied fields.

Studies on molecular structure of DNA, carried out by Watson and Crick at Cambridge over a decade ago, have had many ramifications in the development of human genetics and development of knowledge about cancer, immunology, and microbiology.

The electron microscope, so essential to health research, depended for its development on the contribution of physicists and their knowledge of the laws concerning the behaviour of light and the behaviour of electron beams.* This is a good example of the way ideas and facts can be brought together to exploit research in several disciplines.

Basic research on the nervous system of lower organisms is of importance to neurologists, neurosurgeons, psychiatrists and anaesthesiologists. The ruminant has a digestive tract so different from man that it serves as a useful model in comparative physiology. Physical and mental stress in man is studied by physiologists, pathologists, and psychologists. Neurological diseases in dogs and cats, as in man, are difficult to diagnose and treat. Studies in electroencephalography, refinements in the techniques used in brain surgery, the tracing of nerves at the spinal column and similar fields are of importance alike to human medicine, and veterinary medicine and have a definite relationship to the research being done by psychologists using the lower organisms. One of the obvious advantages of using animals as tools in biomedical research is the fact that chronic experiments can be planned and executed—e.g., the problem of atherosclerosis and diet. Genetics and nutrition are two subjects that engage the animal science specialists in intensive study. Many projects have a bearing on health research and could be oriented more in this direction if supporting funds were made available.

Epidemiology is a subject of importance and is bound to require more attention by the biologist, the veterinarian, and health scientists in general, to improve the research programmes in this area.

* "Quantum Electronics, and Surprise in Development of Technology, the Problem of Research Planning," Charles H. Townes, *Science* Vol. 159 (No. 3816): pp. 699-703, 1968; and *Technology in Retrospect and Critical Events in Science (TRACES)*, prepared for the National Science Foundation by the Illinois Institute of Technology, Research Institute, under contract NSF-C535, Vol. 1, December 15, 1968.

Animals and some of their diseases serve as models for Physiology and Pathology. For example, lesions in chronic swine erysipelas involve both the joints and the heart valves and this disease in pigs is very useful in elucidating information on arthritis and heart disease in man. Other similarities between man and the pig make the latter useful in the study of lipid metabolism, haemophilia, blood coagulation disorders, and the micro-circulation.

Research on pharmaceuticals, pesticides and other residues needs more involvement by provincial authorities and will require a detailed study of the chain linking wildlife to food producing animals and to man. The effects of micro-organisms and chemical compounds on the various biological systems must be better understood if we are to know their ultimate effects on man.

The importance of social and economic research into the general mechanisms of the cause of disease in communities of people should be noted. A great deal of the early work in this field was undertaken by British scientists particularly in the fields of malnutrition and poverty. Recently a great deal of interest is being taken in the United States in social and economic causes of mental and physical disease in certain ghetto communities. Similar well-planned and objective work is needed in Ontario.

AGRICULTURAL RESEARCH

Extensive programmes of agricultural research are undertaken in Ontario. Most of these are supported by the Ontario Department of Agriculture and Food. Information about the organization of agricultural research through the Agricultural Research Institute of Ontario is included as an appendix to this section.

The Institute supports mission-oriented research which has a direct interest in man's needs for food and raiment. It has been recognized that substantial support for basic research is necessary in order to achieve the objective of the Institute.

Because of the emphasis on man's welfare, it is not surprising that the programme of agricultural research includes several projects that have a bearing on human health. This is particularly the case at the Ontario Agricultural College, in the Departments of Animal Science, Poultry Science, Nutrition, Horticulture, and Food Science. It is true, however, that agricultural research is oriented toward the economic value it has and often does not take into account the effects of new developments on human health.

The Ontario Veterinary College receives most of its support for research from the Institute.

Since many major advances in the health sciences have had their origin in basic biological discoveries, research in biology, social science, and agriculture, should be eligible for support by health agencies. Departments of universities engaged in social science, agricultural or biological research, should be eligible for research grants from the Ontario Department of Health when the project is considered relevant to health research, within the terms of reference of the provincial role in health research.

POLLUTION

Man is responsible for changing the quality of his environment by introducing a variety of physical, chemical, and biological agents, usually as by-products to his activities. When these are deleterious to man, either directly or indirectly, they are called pollutants. Deleterious agents in air and water, herbicides and pesticides used in agriculture and in the management of parks by municipalities and other agencies, certain kinds of food additives and additives to animal feed, and various undersirable noises, are all classed as pollutants. Radiation can also be a pollution problem.

Tables 1 and 2 are taken from the 1969 Cummings Memorial Lecture to the American Industrial Hygiene Association entitled: "The Spectre of Today's Environmental Pollution—U.S.A. Brand: New Perspectives from an Old Scout," by Dr. Herbert E. Stokinger, Bureau of Occupational Safety, U.S. Public Health Service.

Table 1 gives a list of substances with possible long-term effects on human health when they exist at potentially hazardous levels in the environment.

Table 2 lists the disease states for which evidence points to environmental pollutants as either direct or contributing causes.

The responsibility rests with public health officers to provide a vigilante role regarding pollution. If this role is to be effective, the people responsible must be supported by technical services for the investigation of problems in this area as they arise, and to engage in a research programme aimed at reducing the hazards and, in some cases, to prevent them from occurring. There is need for a strong health component as part of the environmental management team.

TABLE I
Substances with Potential Long-term Effects on Human Health at Environmental Levels

Substance	Major Source			Effects Singly	Effects from Combinations
	Water	Food ^a	Air ^b		
Arsenic	+	+++	+	Carcinogenicity not proven Mesotheliomas	Se-As antagonism Tumors mediated by 3, 4-benzpyrene and trace metals
Asbestos	+	+	++		
Beryllium	—	—	+	Chronic berylliosis Cancer (?)	Fluoride potentiation
Cadmium	+	++	—	Renal hypertension (?) Teratogenic in animals at high doses	Zn antagonism Se antagonism
C.C.E. ^c	++	—	—	Influences cancers from natural causes	CIHC ^d toxicity increase in protein- deficient diets Piperonyl butoxide potentiates insecticides, carcinogens
Carcinogens and anticarcinogens	+	++	+		
Teratogens	—	—	—	None-at-or near FDA tolerance levels	
Mutagens	—	—	—		
Pesticides and economic poisons	+	+++	—		

TABLE I (continued)

Major Source

Substance	Water	Food ^a	Air ^b	Effects Singly	Effects from Combinations
Chromium Fluoride	± +	++ +	± ±	Deficiency affects atherosclerosis Prevents dental decay, osteoporosis, aortic calcifica- tion, defective hearing	Increases lead (Pb) toxicity Se antagonism
Gaseous Pollutants Carbon monoxide	—	—	++	Decreased sensory behavior	May aid atherosclerosis,
Nitrogen oxides					$\text{NO} \xrightarrow{\text{uv}} \text{NO}_2 \rightarrow \text{O}_3$
Ozone and photochemical oxidants				Accelerate aging, cancerigenesis, emphysema; alters pulmonary diffusion, visual acuity	Potential by particles, accelerate cancerigenesis $\text{SO}_2 + \text{O}_2 \rightarrow \text{SO}_3$
Sulfur oxides					
Lead (Pb)	±	++	++		Cr deficiency enhances Pb toxicity
Nitrates	++	±	—	Methemoglobinemia and death in infants	

TABLE I (continued)

Major Source

Substance	Water	Food ^a	Air ^b	Effects Singly	Effects from Combinations
Organic Particulates Asthmagenic agents Oil mists	—	—	++	Allergic asthma	Hereditary predisposition Protection of lungs from effects of inhaled irritants
Selenium	+	++	—	Increase susceptibility to dental caries, G.I. disturbances, icterus	As-Se antagonism
Waters, “hard” and “soft”	++	+	—	Influences cardiovascular disease	

^aAnd beverage

^cCarbon-chloroform extract

^bIncluding tobacco smoke

^dChlorinated hydrocarbon pesticides

TABLE 2
Disease States for which Evidence Points to
Environmental Pollutants as either Direct or Contributory Causes

Disease	Geographic Distribution General	Relative Incidence Index*	Etiologic Pollutants Associated Conditions	Direct	Contri- buting
Accelerated aging	+	High	Ozone and oxidant air pollutants	+	
Allergic asthma		+	Airborne denatured grain protein and other	+	
Cardiovascular disease Atherosclerotic heart disease	+	High	“Hard” waters and hereditary tendency CR deficiency states. CO(?)		+
Berylliosis		+	Airborne Bc compounds	+	
Bronchitis		+	Acid gases, particulates, res. infection, inclement climate		+
Cancer of the G.I. tract	+	• Medium	Carcinogens in food, water, air and hereditary tendency		+
Cancer of the respiratory tract	+	Medium	Airborne carcinogens and hereditary tendency		+
Dental caries		+	Sc	+	
Emphysema	+	Medium	Airborne respiratory irritants and familial tendency	+	

TABLE 2 continued

Disease	Geographic Distribution General	Local- ized	Relative Incidence	Etiologic Pollutants Associated Conditions	Direct	Contri- buting
Mesotheliomas	+		Low	Asbestos and associated trace metals and carcinogens, (air, water) (other fibres?)	+	
Methemoglobinemia infant death		+	Low	Water-borne nitrates and nitrites	+	
Renal hypertension		+	Low	Cd in water, food and beverage in As and Se-low areas (?)		

* A composite index derived from an estimate of incidence, geographic extent, and seriousness of effect.

Complementary to this programme is a compelling need for a group of health scientists to conduct epidemiological research on disease states related to pollutants. The advantage of cohabitation with other health researchers makes the health sciences centres suitable for pollution research, oriented to health problems. In addition, there is a component of pollution studies that must be included in health research. A good example is cell-biology research with pollutants.

Universities should be encouraged to develop programmes for research into health problems related to pollution.

Certain aspects of investigation are appropriately done by personnel of the Department of Health. Projects are presently under way by the Environmental Health Services Branch, Public Health Division.

Encouragement should be given to the expansion of Department of Health investigation into pollution problems.

The important question arises whether existing agencies can give all the support required by health officers responsible for dealing with pollution problems as they arise. Are they in a position to emphasize paths of enquiry regarding the pathogenesis of diseases caused by, or assumed to be caused by pollutants, and do they appreciate the depth of basic research necessary for a fruitful programme of investigation into the health hazards of pollutants?

In September, 1968, the Minister of Health received the "Report of the Committee appointed to inquire into and report upon the pollution of air, soil, and water in the townships of Dunn, Moulton, and Sherbrook—Haldimand County."

Recommendation 790 of this report is of interest:

Pollution is a natural and ingrained fact of life. Pollution control is yet in its infancy. We suggest that the government adopt an even greater sense of urgency in developing 'anti-pollution' policies and in establishing the organization to implement them. We feel that a study of this extremely complex problem is of the utmost importance in the immediate future. Any changes which might be made in the organization, in order that pollution control may be more effective, should be welcomed, even if recommendations

emanating from such a study include the establishment of a Department of Environmental Health or a Department of Pollution Control.

Behind a campaign to marshall the energy and skill necessary to conquer this problem in the United States, and underlining the great importance of the problem of pollution, is the recent establishment of the Environmental Quality Council, of which the U.S. President is Chairman. The immediate problem is the "Availability of good air, and good water, or open space, and even quiet neighbourhoods." Such a general problem makes pollution a subject of pan-disciplinary concern, but there is no doubt about its importance to health agencies and those allied to them.

Serious consideration is warranted over the problem of pollution in Ontario. A rapid increase in population has resulted in expansion of industry and urban development. Adequate plans need to be formulated now to cope with management of the environment, which will be affected to the point of alarm if appropriate action is not taken on all aspects of pollution. We need to develop the facilities and personnel to improve our knowledge of pollutants and we must have a better understanding of their effects on man, how they can be detected, and how much of them can be tolerated.

This is one of the most important areas of health research which requires the active participation of persons in the health sciences.

There is a need for health research in pollution. This activity should be related to an Ontario Environmental Quality Council (or some other appropriate name), made up of informed and interested persons, charged to provide advice to government on all matters related to pollution.

The study mentioned in Recommendation 790, quoted above, should determine the kind of programme that is required in Ontario to meet the specific needs of health research in pollution.

In view of the foregoing considerations it is further recommended:

40. THAT since many major advances in the health sciences have had their origin in basic biological discoveries, research in biology, social science and agriculture should be eligible for support by health agencies. Departments of universities engaged in

social science, agricultural or biological research should be eligible for research grants from the Ontario Department of Health when the project is considered relevant to health research, within the terms of reference of the provincial role in health research.

41. THAT recognition be given to the importance of a comprehensive research programme on pollution, with priorities, and including a health research component. Universities should be encouraged to develop programmes of research into health problems related to pollution. Encouragement should be given to the expansion of Department of Health investigations into pollution.

42. THAT, in order to have a satisfactory overview on pollution and to develop sound policies for reducing their hazardous effects, we urge the appointment of an Environmental Quality Committee of the Ontario Council of Health, made up of informed and interested persons, charged to provide advice to government on all matters related to pollution.

APPENDIX A

AGRICULTURAL RESEARCH IN ONTARIO

The Agricultural Research Institute of Ontario was established by an Act of the Legislature in 1962. Members are appointed by the government and at present there are twelve private citizens, two assistant Deputy Ministers of the Department, a full time officer as Director, and a Comptroller. The Institute has three main objectives:

1. to inquire into programmes of research in respect to agriculture, veterinary medicine, and household science;
2. to select and recommend areas of research for the betterment of agriculture, veterinary medicine and household science; and
3. to stimulate interest in research as a means of developing in Ontario a high degree of efficiency in the production and marketing of agricultural products.

Research programmes and budgets are reviewed by the Institute each year, for projects to be undertaken at the various stations operated by the Department of Agriculture and Food, and at the University of Guelph. Supplementary support for some projects is given by various granting agencies.

Over one thousand projects are supported by the Institute, covering research involving microbiological agents of disease, insects, all classes of livestock and poultry, field crop and horticultural plants, soils, engineering, various aspects of veterinary medicine, foods and nutrition, textiles, economics and marketing. Service programmes in agriculture and veterinary medicine are also carried out under contract with the University of Guelph on a cost basis. Some of these include diagnostic laboratories for animal diseases, frozen semen laboratory, soil testing, etc.

In addition to the reporting of research in the appropriate scientific journals, the Department of Agriculture and Food interprets the results obtained, and the formulation of recommendations

in various extension publications and releases, through its own Information Branch.

A report of the Agricultural Research Institute is tabled in the Legislature each year. Some of the programmes described in the annual report show a clear association at the interface of medicine, veterinary medicine, and the broad field of biology. The report also gives evidence of a provincial resource which should be used where appropriate, in the interest of the public's health and welfare. This is so because the main emphasis of research of interest to the Agricultural Research Institute is economical food production, including in particular the factor of disease as one of the major hazards of plant and animal production.

SECTION XI

Role of Federal Agencies

The federal government has been involved in research support for a number of years. It has done this through the medium of several different agencies, depending on the area of research being done. Only some of these are of particular relevance to Health Research in Ontario, the most important being the Medical Research Council of Canada (MRC), the National Research Council of Canada (NRC), the Department of Health and Welfare (DHW), the Defence Research Board (DRB) and the Department of Veteran's Affairs (DVA).

Each of these organizations operates within certain frames of reference. The MRC is the main granting body for support of health science research in Canada. Its aim is to "promote, assist and undertake basic, applied, and clinical research in Canada in the health sciences, other than public health research." The NRC is more broadly based since it supports research in physics, chemistry, engineering, and biology. Nearly all research in biology departments in universities is dependent on NRC funds. The frame of reference of the Department of Health and Welfare has been changing in recent years but, in general, the approach has been to support research pertaining to public health problems. In the past this has been interpreted rather broadly but there are indications that the programme will be more narrowly focussed in the future. The Defence Research Board has offered support in areas considered of importance in defence, including biology. The Department of Veterans Affairs granting programme has involved a broad clinically oriented spectrum of problems. It is probable that both the DRB and DVA programmes in biology will be seriously curtailed in the future.

In addition to these agencies, special federal funding mechanisms have been developed for specific purposes. One example of this is the Health Resources Fund, a fund set up in 1965 to finance capital construction and related equipment in health facilities. In general, the provinces provide matching funds for this programme.

As might be expected, the fields of interest of each agency are not too easily delimited, and it is difficult to decide whether certain biological research belongs within the purviews of the NRC or the MRC; or in health research, within MRC or NHW; or what type of biological or health research is related to defence.

Up until recently, because of such conceptual difficulties, individuals seeking support might apply for (and receive) support from two or three of the above agencies. Attempts are now being made to allocate individual applications to only one of these agencies, although the basis for such decisions may be questionable.

The federal agencies offer support in three basic areas—project, equipment, and personnel. The bulk of support is directed at projects of individuals, or groups of investigators. These are awarded for one to three years according to a diversity of procedures, depending on the agency. In general, however, one of the essential features of nearly all systems is the allocation of grant funds on the basis of judgment of peers drawn from the total scientific community in Canada. The major criteria for support are theoretically those of excellence, although especially in DRB, DVA and NHW, the mission-orientation of the work plays some role in decisions.

The national or federal granting scheme serves at least two important purposes. First, it allows an allocation of resources on the basis of national goals. Second, by using panels of peers from all over the country in judging grant requests, a federal system provides the best means for ensuring that national standards are applied, and tends to avoid an excess of parochialism at the local level. Because of these important considerations, it is necessary that the present general scheme of funding by federal agencies be continued.

However, while recognizing the advantages and the role of the federal agency systems, it is also evident that because areas of provincial responsibility such as education and service impinge so closely on research, and because certain aspects of research may essentially be related more to regional needs, the province must continue to bear a major responsibility in all activities related to

health care. Because of the involvement of both federal and provincial agencies, it is important therefore that efficient mechanisms be generated to recognize, to adapt, and to co-ordinate the various activities at both government levels. The needs for such co-ordination are evident in many ways, but are perhaps best exemplified by reference to some of the recommendations in the recent Macdonald Report* on federal support to the universities. In general, this report neglects the provincial role in support of research, justifiably perhaps, since the terms of reference of the Committee were related only to the federal scene. However, as will be seen below, such a federal role cannot be considered in isolation, since federal decisions will have their impact at the provincial level and will have to be co-ordinated with the regional needs of the provinces in similar areas.

The Macdonald Committee recommends the creation of a Health Sciences Research Council for the support of all health research in Canada and a Canadian universities' research board as an advisory body to the government for allocation of federal funds for research. Without arguing the merits of these recommendations, it must be realized that the activities of such bodies will reach into the education and service functions of the health sciences centre, as well as into its research functions. Since the Province of Ontario is already committed to active programmes in all of these areas, the creation of these federal bodies and, more important, their terms of reference must be considered in conjunction with, rather than independent of, the provincial programme. These are problems which should be resolvable by proper organization, if the aims and responsibilities of the various groups are clearly identified.

The possible impact of federal decisions on provincial programmes is further illustrated by some of the other recommendations of the Macdonald Report. For example, the report recommends that federal research councils make available group grants (a present MRC policy), pay the full indirect costs of research (not a present policy—but see Section II of this report), discontinue programmes such as the present MRC associateships, and discourage the payment of graduate students out of grants. Each of these recommendations obviously impinges on the evolution of the Health Research Centres in Ontario and is, therefore, of concern to the provincial government. We have made recommendations in respect to some of these matters

* "The Role of the Federal Government in Support of Research in Canadian Universities," Special Study No. 7, prepared for The Science Council of Canada and The Canada Council, 1969.

in other sections of this report (cf. Sections I-III). It is questionable, for example, whether support of groups directly from federal funds, and relatively independent of service and teaching functions, is in the best interests of the health sciences centres; it is not clear what effect the elimination of the MRC associateships would have on the health sciences centres; the possible impact of changes in federal funding procedures in respect to graduate students is considerable.

Another example of the need for co-ordination of provincial-federal activities comes from the history of the use of the Health Resources Fund as pointed out elsewhere in this report (Section II). Decisions made at the federal level on the mechanisms of administration of this fund have, and will continue to have, profound effects on the development of the health sciences centres in Ontario.

The relative roles of the provinces and the federal government in all of these aspects of health research are yet to be formulated but clearly they should be determined by an integration of the aims and aspirations of the health sciences centres, the community and the provincial and federal government. In this way funds can enter into various aspects of health research in a co-ordinated manner.

Clearly there are both national and regional research goals. The federal government has furthered programmes at the national level through its granting agencies (see above) and also indirectly through grants to the provinces. In considering provincial goals, it should be recognized that the concept of regionalization has been well developed in Canada in respect to education and health. This concept is of importance because it is probably the most efficient means for meeting specific community goals in these areas. The need to develop regional programmes of high quality medical care is best served by supporting the educational, research, and service requirements of health sciences centres in the community. Fortunately the trend in hospitals and universities is in the direction of a co-ordination of all facets of health care through their health sciences centres. But it is to be expected that, although these centres will have many features in common, they will also be unique since each community will have its own problems and its own goals. The province must bear a major responsibility in this area.

In view of the foregoing considerations it is recommended:

43. THAT taking into consideration Recommendations 44 and 45 of this Section, the Province

affirm the concept of allocation of federal resources for health research on the basis of national interest, and the general scheme of funding by federal agencies.

44. THAT because of regional needs and specific community goals, and because of the continuing role of the Province in the interrelated areas of teaching, service, and research, the Province maintain a strong health research capability (ref. Section I).

45. THAT, because of Recommendations 43 and 44 above, the mechanisms of co-ordination between provincial and federal authorities be strengthened by appropriate provincial representatives on national bodies, and/or by the constitution of special committees for this purpose.

SECTION XII

Health Care Research

INTRODUCTION

Health research may be defined as: “all systematic study directed toward the development and use of scientific knowledge through fundamental research in the laboratory, clinical investigations, clinical trials, epidemiological studies and engineering studies.”¹

This definition is very broad, and it is useful to divide health research into two sub-categories. The first of these, *biomedical research*, has been defined elsewhere in this document (Section I) as:

Health research in the following areas:

- (1) The causes, diagnosis, treatment, control, prevention of, and rehabilitation relating to the physical and mental diseases and other killing and crippling impairments of mankind.
- (2) The origin, nature, and solution of health problems not identifiable in terms of disease entities.
- (3) Broad fields of science where the research is undertaken to obtain an understanding of processes affecting disease and human well-being.
- (4) Research in nutritional problems impairing, contributing to, or otherwise affecting optimum health.

- (5) Development of improved methods, techniques, and equipment for research, diagnosis, therapy and rehabilitation.¹

The second broad category, health-care research, is defined as the systematic inquiry into the need for, process of, and effectiveness of community health services.

Both of these types of health research are necessary in the development of a sophisticated health care system. Knowledge is advanced by biomedical research, and the results of this research are then applied in a new form of therapy or prevention. The effectiveness of this new therapy in preventing or treating disease should then be assessed in a *health-care research* experiment such as a “randomized clinical trial” in which the end-results among patients who receive the new therapy are compared with those among an identical group of patients who do not receive the new therapy. This new therapy, if effective, is then added to the array of generally available health services, with additional *health-care research* studies to determine how those members of society who will benefit the most from this new therapy can do so in an economical fashion.

A Health Care Model

The central issue in the development of policy governing the establishment of priorities in providing health services in the province is the selection of a criterion for deciding which health services are to be supplied, in what amounts, by whom, and under what circumstances; financial and personnel resources must be allocated in such a fashion that optimal health is achieved by all members of society.

In establishing criteria for the support of research and training programmes related to health care, it is, therefore, important to consider the relevance of the proposals in respect to the above central issue. Alternative approaches to the development of this decision criterion should be considered, the most powerful and appropriate of those should be selected, and the priorities and implications which arise as a result of this selection should be indicated.

In order to identify the central issues, to consider the possible approaches to establishing programme priorities, and to realize the implications of preferred approaches which are selected, it is useful to consider a descriptive model of health-care (Figure 1).

A HEALTH-CARE MODEL

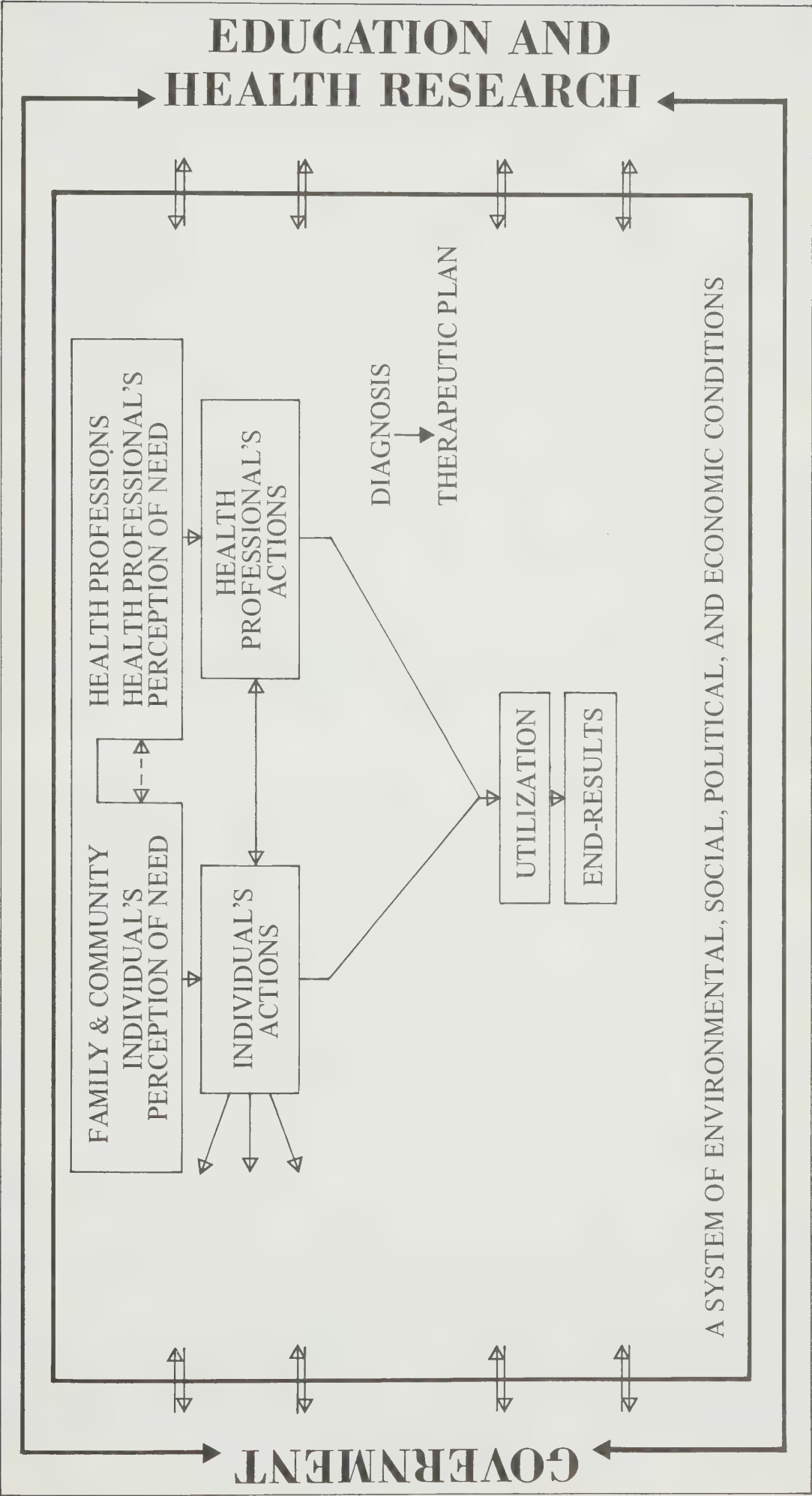


FIGURE 1

The model consists of a community (which might represent a small population centre or the entire province), existing within a series of environmental, social, political and economic conditions which determine the type and extent of health services available in that community. The Health-Care System is intimately associated with two additional systems.

The first of these, government, acts upon the behalf of the community to establish the conditions within which the health service and other systems operate. The realization of optimal health by the community depends, in a crucial fashion, upon the extent to which government perceives the role, function, and effectiveness of both the components and the totality of the health services system. The second interacting system is that of education and health research (both biomedical research and health-care research) which is primarily community- and university-based. This system, to the extent that it is attentive and responsive to the health services system, is in the position both to provide government with vital information concerning the components and effectiveness of the health services system and to collaborate with government in the establishment of programmes of health-professional education and research designed to achieve the goal of optimal community health in a cost-effective fashion.

As indicated in the model, individual members of society, in an effort either to maintain or to improve their health status and that of their families and communities, perceive needs for health services. At the same time, a second segment of society, namely the health professionals, has also developed a perception of the health-care needs of citizens. The dotted line (Figure 1) extending between the individual's and health professional's perceptions of need emphasizes the fact that they may not agree upon the health-care needs of either the individual or society as a whole, a point which must be borne in mind when considering the varying demands for health services which arise from different groups within society.

At any rate, the individual translates his perception of need into action, and it is important to note that this action need not involve a health professional at all; the individual could seek satisfaction from self-medication, family- or other lay-consultation, or a wide variety of health-related professionals. It is only when the individual seeks out a health professional that we have the creation of the health professional-patient relationship and a series of actions which lead to the establishment of a diagnosis and therapeutic plan. That these

activities of the health professional are of great importance is undisputed; that they constitute the preoccupation of medical education, to the exclusion of the consideration of other portions of the health-care model, is highly inappropriate.

Utilization, to a greater or lesser extent, of health services follows, and it is noted that this utilization requires continued co-operation between the patient and the health professional. And, finally, the patient arrives at some end-result which can be defined in terms of survival, a series of levels of physical, social, and emotional function, and a series of feelings and attitudes about the health services system and the health professionals whom the patient has met within it.

Using this health-care model as a point of reference, alternative research approaches may be considered for obtaining information to assist policy-makers in determining which community health services should be supplied, by whom, in what magnitude, and in response to what indicator of need.

ALTERNATIVE RESEARCH APPROACHES TO IDENTIFYING PRIORITIES IN HEALTH SERVICES

Within the context of the health-care model, four broad categories of health-care research approaches to identifying a criterion for priorities in providing health services can be identified:

- (a) Research into individuals' perceptions of need and actions.
- (b) Research into health professionals' perceptions of need and actions.
- (c) Research into end-results among individuals who have utilized health services.
- (d) Research into economic analyses of the system of inputs and outputs.

A. Research into Individuals' Perceptions of Need and Actions

Such research seeks to identify and quantify the self-perceived needs and demands for health services identified by the consumers of these services; such studies include investigations of the actions of individuals as extensions of their perceptions of need². This type of

research, which may be referred to as *process* research, studies how individuals develop perceptions of health needs (*consumer demand*) and what individuals do as a result of these perceptions (*consumer utilization of health services*).

Although the ability of such *process* studies to characterize the behaviour of individuals who enter the health service system is not denied, this line of investigation is seen as deficient for two interrelated reasons: First, *process* research fails to link either perceived health needs or individual actions to the maintenance or improvement of health; such considerations of effectiveness are beyond the scope of *process* research. Second, and as a result of this, if the individuals' perceptions of need are the result of their acceptance of the unwarranted conclusions of well-intentioned but over-zealous health professionals, health service resources spent on the basis of the results of *process* research might not have any beneficial effect upon the maintenance and improvement of health in the province.

Three examples will be given to illustrate the nature of *process* research, and to indicate its limitations. First, over the last two decades considerable *process* research has thoroughly characterized both the perceived health needs and the actions of women who are offered periodic cytologic examinations of the uterine cervix (*Pap smear*)³. On the basis of these findings, it is now possible to funnel health resources into cervical cancer screening programmes with a high degree of certainty concerning the extent to which they will be utilized by women in the target populations. However, the effectiveness of such programmes in *maintaining or improving the health status of persons or populations* is not guaranteed, since, as pointed out earlier, such considerations of effectiveness are beyond the scope of *process* research directed at patients' perceptions of need and actions. Indeed, in this example, the effectiveness of the procedure is open to serious question; the age-standardized mortality rate for cancer of the cervix in British Columbia (where a generalized cervical cancer screening programme has been in operation for twenty years) is no lower than in areas of Canada where no such programme is in operation⁴.

In the second example, the general community's concern over coronary heart disease is quite appropriate in view of the magnitude of the problem. Because the great risk of dying within a few minutes of the appearance of symptoms of a heart attack prevents many of its victims from receiving any therapy, the prevention of heart

attacks has taken on additional importance in the eyes of both health professionals and the community at large. Appropriate experiments (particularly the controlled clinical trials mentioned earlier) are now being planned or are already in progress to determine whether changing certain *predicators* of heart attack (such as high cholesterol and low exercise) will reduce the risk of having a heart attack, and these questions should be answered soon. In the meantime, well-intentioned and highly concerned physicians have occasionally created the false impression in the general community that these questions have already been answered in the affirmative, tending to create a public demand for coronary prevention programmes in the absence of any assurance that such programmes will, in fact, be of any value in the prevention of heart attacks.

Process research which measures the *demands* for a physical exercise programme presumed to reduce the risk of heart attack is of little value if such a physical exercise programme is ineffective in actually reducing the risk of heart attack.

The third example relates to the *screening* of the general community for a series of diseases which can be detected before symptoms begin. Since it is possible to detect many chronic diseases (such as diabetes, glaucoma, and some cancers) months or even years before they become symptomatic, it has been suggested that the initiation of therapy in these very early stages may prolong the lives of the afflicted by arresting or slowing the progress of these diseases. The attractiveness of this approach appears to have been transmitted to the general community in an uncritical fashion; increasing public demand for multiphasic screening programmes has resulted. The extent and character of this public demand can be characterized through *process* research. That a response to this demand, in the form of provincial multiphasic screening programmes, would have only minor health benefits is attested to by the recent results emerging from experiments which indicate that most of the disorders being detected in these screening programmes are not favourably affected as a result of early diagnosis⁵.

The establishment of priorities for the expenditure of health service manpower and financial resources on the basis of research directed toward characterizing individuals' perceptions of need and individuals' actions is therefore considered inappropriate; such a course of action could result in the dedication of resources to activities which have no effect upon the maintenance and

improvement of the health status of persons and populations in the community.

The preceding comments are in no way meant to advocate indifference to individuals' perceptions of health needs; on the contrary, these perceptions should constitute a major impetus to health research. The expression of community concern should provide a major stimulus, indicating the areas in which major research efforts should be directed for the discovery and testing of preventive, curative, and rehabilitative programmes of health care.

B. Research into Health Professionals' Perceptions of Need and Actions

Such research seeks to identify priorities in health services either through identifying and collating recommendations of health professionals (based upon their individual assessments of available data), or through extrapolating from the behaviour observed among a sample of health professionals. An example of the former approach is that of the President's Commission on Programmes to Conquer Heart Disease, Cancer and Stroke in the United States, in which a group of prominent health professionals summarized their opinions concerning, among other things, how individuals with certain conditions should be treated⁶. Examples of the latter are the several physician-patient ratios and *quality of care* studies based upon the observation of health professionals as they carry out technical procedures⁷.

Clearly, these research approaches constitute further examples of *process* research. In this case, the research is directed toward the description, measurement, and analysis of what health professionals believe to be health needs, and what they do as the result of these beliefs.

The setting of policy on the basis of health professionals' perceptions of need, in addition to merely expanding currently accepted therapy, involves accepting highly questionable assertions as well as firm scientific evidence. One need only consider some of the *recommended* therapies of former eras to emphasize the fact that the execution of recommendations based upon *currently accepted therapy* need not lead to the improvement or maintenance of health in the community. For example, the venesection (*bleeding*) of ill patients was once a generally accepted form of therapy, and the doubtful value of tonsillectomy has only recently been pointed out. The controversy over the usefulness of anticoagulants in treating

heart attacks continues to rage, with articulate proponents of both polar views⁸.

Quality of care studies, in which one might, for example, observe whether a physician has his patients completely undress before he examines them, whether he does certain tests before prescribing certain specified drugs, etc., in which the conformation of a health professional's actions to either his colleagues or to some *ideal* standard is assessed, is seen as having the same set of shortcomings as the *process* studies directed toward individuals. The pertinence of a series of health professionals' actions to the maintenance and improvement of community health is not necessarily assured; again, this is underscored by a consideration of accepted procedures of even a few years ago.

The conclusion regarding the usefulness of research directed toward the health professionals' perceptions of need and actions in establishing priorities in the provision of community health services is identical in kind to the conclusion reached in the previous section. Reliance upon the results of such *process* research carries with it the risk of the allocation of resources to programmes which will have no beneficial effect upon community health.

As in the prior sub-section, it is emphasized that health professionals' perceptions of need and actions *are* viewed as highly relevant considerations in determining priorities for research, particularly into the experimental testing of new approaches to health care; furthermore, there is no question that the health professional must decide the merits of alternative approaches to the management of individual patients upon the basis of his clinical judgment. The provision of broad health services to the community at large, however, must be based upon universally accepted demonstrations of effectiveness in maintaining and improving the health of society.

C. Research into End-Results among Individuals who Have Used Health Services

A third method for establishing priorities for providing health services is to make a comparison of outcomes among individuals who have received various forms of these services⁹. The end-results or outcomes should include not only the gross measurements of *disease* (such as disease mortality, disability, and discomfort), but also positive measures of *health* (such as physical, social, and emotional function and satisfaction).

This approach has two distinct advantages. First, the outcome measures are directly related to health: they are direct measures of the *physical, mental and social well-being* which constitute the World Health Organization definition of health. Second, this approach permits the application of a series of powerful design and analytic techniques in a situation in which the result is a measure of health; the randomized clinical trial and other experimental techniques can be exploited with the attendant strengthening of causal associations. To cite but two examples, end-results research demonstrated the effectiveness of killed and live vaccines in the prevention of poliomyelitis, and this same experimental approach has shown the benefits which result from the medical treatment of severe hypertension¹⁰.

The ability of this combination of experimental designs, coupled with end-result measures to assist in assigning health service priorities, has been repeatedly demonstrated in vaccine-evaluation trials; identical randomized designs and measures are now being employed to determine the effectiveness of:

- (a) technical procedures (whether periodic breast x-rays, mammography, can reduce breast cancer mortality)¹¹.
- (b) deployment of health professionals (whether diabetics *function* as well when cared for by a nurse as when cared for by a physician)¹².
- (c) the effectiveness of entire segments of health service programmes (whether periodic health examinations improve outcomes among those who are screened)¹³.

D. Research into Economic Analysis of the System of Inputs and Outputs

End-results research, even when performed utilizing experimental designs such as the randomized clinical trial, is an approach which falls short of completely satisfying the prerequisites for setting priorities, however, because it does not usually include a consideration of dollar costs and benefits for the alternatives being compared. This need can be satisfied by research involving economic analysis of the health care system.

Utilizing this approach, individual component health services in the system are considered from the point of view of their costs, the

cost to society of the disease-conditions they are designed to prevent, delay, or relieve, and the improvements in health status which their recipients experience¹⁴. This improvement in health may be translated into its monetary value to society (as in cost-benefit analysis) or kept in the sort of health terms referred to as *end-results* in the previous sub-section (as in cost-effectiveness analysis). Using either of these approaches, one could combine the *benefits* or *effectiveness* of an entire series of health services and determine which apportionment of health resources, applied to which programmes, would lead to the greatest improvement in the health of society.

The cost-benefit and, particularly, the cost-effectiveness approaches possess one major advantage in common but also suffer one major common shortcoming. The advantage is that they can be used to achieve maximum effectiveness, in terms of community health, for each health-care dollar spent. The drawback is their enormous vulnerability to erroneous estimates of the effectiveness of the health services being considered. If, for example, a totally ineffective health service (such as semi-annual chest x-rays for lung cancer detection) is erroneously assumed to be of benefit to community health, the cost-effectiveness approach will fail to uncover this error; the result will be a recommendation for expenditure in a totally ineffective health service programme¹⁵.

This disadvantage can be overcome by utilizing the results of experiments such as those described in the immediately previous section as sources for estimates of the effectiveness of the health services under consideration; that is, the end-results among individuals who have utilized health services under experimental conditions would be used as indicators of effectiveness. The disciplines required for this joint effort include epidemiology, biometrics, health economics, and operations research.

In summary, the most rational approach to the allocation of resources to the provision of community health services is the establishment of priorities on the basis of a combination of:

- (a) the results of research in end-results among patients who have utilized health services in a true experiment;
- (b) the application of cost-effectiveness analysis to the above.

To reiterate all four approaches with a single example, programmes of fluoridation designed to prevent tooth decay will be

used. On the basis of the findings of biomedical research, a randomized clinical trial was performed in which the end-results (dental decay) were compared between the members of one community whose drinking water was fluoridated and the members of a second community whose water was not fluoridated. The results of this experiment showed a striking reduction in dental decay among the individuals drinking fluoridated water.

On the basis of this demonstration of effectiveness, research into the economic analysis of the addition of fluoride to drinking water followed, and cost-effectiveness analyses have resulted in the selection of safe and economical methods of fluoridation.

Community disputes over whether their water should or should not be fluoridated have stimulated considerable *process* research into individuals' and health professionals' perceptions of the need for fluoridation, and the actions which these groups have taken as a result. While this *process* research has been of great value in planning educational programmes to promote this health service, it is recognized that such *process* research would have much less relevance to community health if fluoridation was ineffective in reducing dental decay.

THE RELATIONSHIPS BETWEEN BIOMEDICAL RESEARCH, HEALTH-PROFESSIONAL EDUCATION, GOVERNMENT, AND HEALTH SERVICES RESEARCH

A. The Relationship between Biomedical Research and Health-Care Research

Biomedical research is inseparable from health services research; identical rules of evidence apply, and each should serve as a stimulus to the other. The therapeutic innovations arising from biomedical research should be tested in a health services research experiment; conversely, problems in health services research (such as the differences in responsiveness to drugs of certain subjects in a controlled clinical trial) should indicate fruitful areas for biomedical research exploration. Furthermore, both biomedical and health services research workers should utilize an awareness of individuals' and health professionals' perceptions of need and actions in planning their programmes of health research.

The implications of this view are profound: first, the relevancy of the *totality* of health research, regardless of area, to problems of

community health becomes a criterion for support. Second, health service and biomedical research workers should, insofar as possible, share a common body of knowledge; the system of grant support should foster and nourish interdisciplinary problem-oriented programmes of integrated research.

The implementation of the above suggestions would shorten the time lag between the experimental demonstration of effectiveness of an innovation in prevention or therapy and its application to patients throughout the province.

B. The Relationship Between Health-Professional Education and Health Services Research

Health-care research provides information concerning the extent and characteristics of health problems, effective means of therapy and prevention and cost-effectiveness, and helps to identify requirements in respect to the development of health personnel. Therefore, knowledge obtained by it has major implications for the education of students in the health professions. It is, therefore, essential that educational systems be developed that are able to respond quickly and effectively to the new information from health care research. Once this has been established, it is important to relate it to the continuing education of the health professional.

The education of the health professional is a process which begins with undergraduate course work aimed at academic and professional certification and continues throughout his career.

Provision must be made for a programme which will permit the practising health professional (whether salaried or self-employed) to engage in continuing education without loss of status. Programmes of education should develop much greater relevancy to health-care problems, and must maintain sufficient flexibility to permit extensive changes in the professional activities and responsibilities of their students. In addition, accreditation bodies (both university and professional) must acknowledge this need for flexibility by avoiding restrictive prerequisites for admission and certification.

C. The Relationship Between Government and Health Services Research

Just as educational institutions must guard against ignoring major aspects of the governmental and health services systems in planning

and executing programmes of education and research, government, at all levels, should use the resources and results of health services research in determining and executing health and educational policy. Furthermore, agencies within government, particularly at an intra-departmental level, should make every effort to share resources, personnel, and information.

If the educational, research, and governmental groups are to achieve the maximum maintenance and improvement of the health status of the community at a minimum cost to society, they must collaborate in an *open* system where each submits itself to the scrutiny of the others in order that the community may realize the benefits of this collective activity.

In view of the foregoing considerations it is recommended:

46. THAT highest priority in the funding of health-care research should go to:

- (a) research in end-results among patients who have received health-care in experimental situations;*
- (b) research in cost-effectiveness should be carried out using models, the validity of which has been established by end-results analyses.*

47. THAT, while individuals' and health professionals' perceptions of need and actions are important indicators of health research priorities, "process" research should only be encouraged in areas where the effectiveness of the service programme under study in maintaining or improving health has been demonstrated.

48. THAT, since personnel skilled in the methods of epidemiology, biometrics, economics, and operations research, are required for end-results and cost-effectiveness research, high priority must be given by universities to the training of investigators in these methods.

49. THAT careful consideration should be given to the creation of a health services research capability, both in association with Health Sciences Centres in

Ontario universities and within government, which would combine the disciplines of epidemiology, biometrics, health economics, and operations research. There should be a capability to perform both independent and contract research, provide consultation services, and train additional health-care research workers in these disciplines in these skills.

50. THAT, since biomedical research is inseparable from health-care research, careful consideration should be given to the development of methods which facilitate information transfer between all areas of health research. Special support should be available for integrated programmes of health research which include both biomedical and health-care components.

51. THAT, since universities and the Province share the responsibility for assessing and developing university programmes in education and research relative to provincial health problems, universities, communities, and governmental departments, and particularly groups within these structures, should participate in an open exchange of policy views, information, and manpower.

52. THAT programmes to be supported by the Province, related to health educational and research facilities and experiments or demonstrations in health care programmes, should be assessed by competent groups prior to their initiation.

53. THAT innovations arising from health services and biomedical research should continuously influence health education. Therefore, health professional education must continue throughout the career of the learner, and must be responsive to both these innovations and to the total health services system. Support should be provided for realistic educational programmes in areas relevant to continuous education of health professionals, commencing at the beginning of health professional education.

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